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EARL OF DUNDONALD'S REVOLVING STEAM ENGINE.

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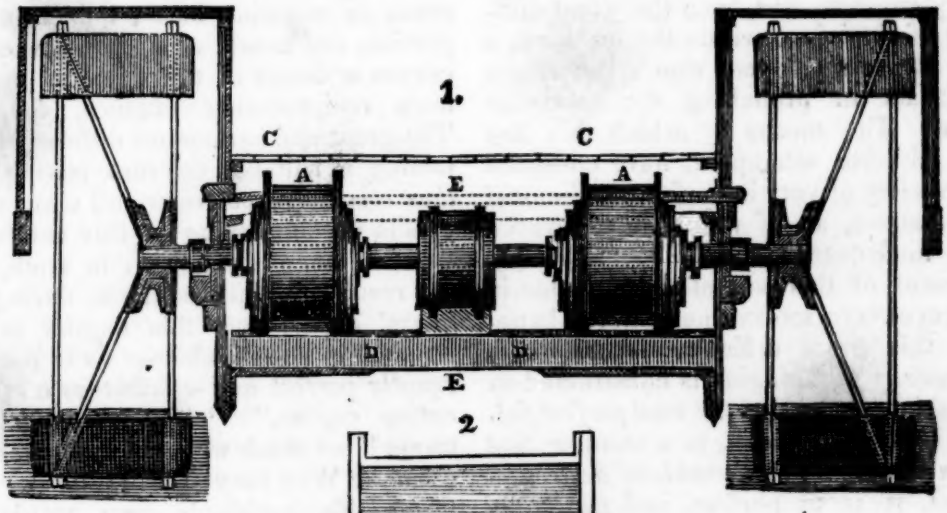

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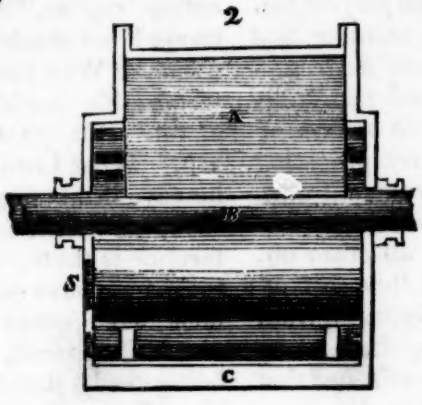

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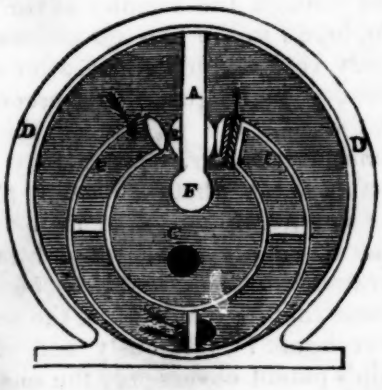

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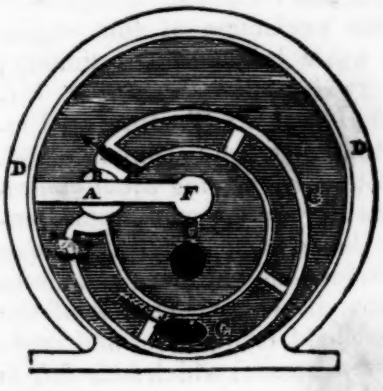

[From the London Mechanics' Magazine.]

THE EARL OF DUNDONALD'S REVOLVING STEAM ENGINE.—The engravings on the preceding page exhibit the construction of a rotary engine, which has been recently patented by the Earl of Dundonald, and the manner of its application to the propulsion of vessels. The Earl himself describes it in a circular, with a copy of which we have been favored, as surpassing in efficiency every thing of the kind hitherto produced—as being, in fact, so perfect, that perfection can no farther go. "The cause," says his lordship, "of the uniform failure in the construction of rotary engines, has been the great difficulty of obtaining, within the machine, a base of resistance on which the steam might act in propelling the moveable piston. The means by which this has been hitherto attempted, have consisted of a variety of very imperfect mechanical contrivances, all of which have proved quite inadequate to the successful employment of this sort of engine; but in the REVOLVING ENGINE now offered to notice, this great difficulty is *completely overcome.* This engine is constructed on a principle that gives *the most perfect fulcrum* or resisting base, in a manner *that leaves nothing on this head to be desired*—indeed, it is as perfect, and nearly as simple, as the fixed cover or bottom of the cylinder of the ordinary reciprocating engine. The great and paramount difficulty of obtaining a suitable fulcrum being *thus completely overcome*, all other obstacles to the employing of this sort of engine at once disappear; in truth, from the result of numerous trials, during two years' experience, it may be affirmed that this engine is constructed in such a manner as to render it *equally perfect and efficient as the best reciprocating engine!*" Nor does the perfection of this engine rest on the noble lord's own testimony; for that very ingenious engineer, Mr. Alex. Gordon, in his "Treatise on Elemental Locomotion," 2d edition, 1834, speaks of it in the following *equally encomiastic terms:* "Of the many rotary engines none have stood the test of long trial; and, indeed, as yet there is none in *practical use*, if we except that of the Earl of Dundonald, (the gallant and ingenious Lord Cochrane,) which bids *fair to rival the best reciprocating engine.* * * The cause of uniform failure of other ingenious persons, in the construction of rotary engines, has been the difficulty of obtaining, within the machine, a base of resistance on which the steam might act in propelling the moveable piston. The means by which this has hitherto been attempted, have consisted of a variety of very imperfect mechanical contrivances, all of which have proved quite inadequate to the successful employment of this sort of engine; but in the REVOLVING ENGINE now under notice, *this difficulty is completely overcome.* This engine is constructed on a principle, that *gives a perfect fulcrum*, or resisting base; indeed, it is as perfect, and nearly as simple, as the fixed covers or heads of the cylinder in ordinary reciprocating engines, &c. &c. The great and paramount difficulty of obtaining a suitable fulcrum having been *thus completely overcome*, all other obstacles to the employing of this sort of engine at once disappear: in truth, from the result of numerous trials, during two years' experience, this engine is constructed in such a manner as to render it *equally perfect and efficient as a reciprocating engine.*" 'Equally encomiastic terms!' we think we hear the reader exclaim—'Why they are literally the same terms—his lordship's own words over again.' So, gentle reader, in truth they are. What Lord Dundonald says, and all he says of his engine, Mr. Alex. Gordon says, and little more; not a tittle of difference is there, in three of the four sentences we have quoted from Mr. Gordon's book, save *just as much* as might serve to make it appear, [no quotation marks being used,] that Mr. Gordon's words are his own words, and not merely a parrot-like repetition of those of his lordship. But though the identity of the language employed in the two quotations be certainly very singular, it is, after all, but an identity in language, not *necessarily* extending to the matter of the extracts themselves. Mr. Gordon may have felt unable to say what he honestly thought of the engine in question, in better terms than those previously used by the noble inventor himself; and if so, can he be to blame that he made use of the same terms over again? Obviously not. His lordship's patent covers only the engine itself—not the words employed by his lordship

to describe its perfections. There could be no piracy in the case—only *a little convenient appropriation*. But, it may be said, if Mr. Gordon was driven by such a sense of fitness to employ the same words as his lordship's, he might at least have had the candor to acknowledge that they were the same, in order that his readers might be enabled to judge for themselves whether they are actually so *fit*—so peculiarly appropriate—that no person desiring to give a *discriminating, independent, and impartial* opinion of the invention, could employ any better; or whether the identity is but such as might be expected, where a person has lent himself to puff the pretensions of another, without any care for truth, honor, or reputation. We confess there is something in this; and, therefore, it is that we have done our best to make up for Mr. Gordon's *not* very candid omission. No one —of *our* readers at least—will now be at any loss to determine for himself the degree of weight which belongs to Mr. Gordon's opinion in the present instance.

Mr. Gordon, it will be observed, goes on one material point considerably further than the Earl himself. The Earl speaks only of "numerous trials" of his engine; Mr. Gordon talks of its being "in *practical use*;" and the words are put in the original, as here, in italics, to impress them more forcibly on the minds of the reader. The obvious intention of the phrase used by Mr. Gordon is to make the public believe that Lord Dundonald's engine has not only had many "trials" by his lordship himself, but has been thought so well of by others—by practical persons, requiring the use of a steam-engine for practical purposes,—that they have had engines made on this plan, in preference to reciprocating engines, and are now actually using them with great advantage. But what truth is there in this? What "practical use" can Mr. Gordon specify? Can he name a single vessel—not a "trial" one merely—where a marine engine, on his lordship's plan, is employed? Or refer us to a single mill or manufactory, where a revolving-engine of Lord Dundonald's is employed as the moving power? We are greatly misinformed, if it is in his power to do any thing of the kind.

It is not, certainly, as an engine in "practical use," nor even as one very likely to be so, that we now bring it under the notice of our readers. We think by no means so highly of it as either his lordship or his echo, Mr. Gordon. We give a place to the present description of it in our pages, for two reasons, very distinct from admiration: first, because of the considerable talk there is about it, owing partly to the celebrity, (for other things than machine inventing,) of the noble inventor, and partly to his prodigiously confident representations of its amazing capabilities; second, because if we are wrong in the opinion we have formed of it, (which not being persons of such infallible stuff as his lordship, nor of such ready faith as Mr. Gordon, we admit to be a possible case)—if it has really left "nothing to be desired," in the way of producing an effective rotary engine —it were a thousand pities that the knowledge of an invention, calculated to confer so much benefit on the mechanical world, and to save so much trouble and mortification to hundreds of ingenious mechanics, who are now occupied with the solution of that problem, of *which it is said to furnish the best possible practical solution*, should not be as speedily and as widely diffused as possible.

Fig. 1 is a representation, copied from Lord Dundonald's circular, of two engines of this description applied to the propulsion of a vessel. A A are the engines; B the air-pump; C C the deck; D a strong beam on which the engines and air-pump rest; E the space for the boiler. Figs. 2, 3, and 4, are sectional views of one of the engines, exhibiting, under different aspects, the peculiar mode of construction by which Lord D. flatters himself he has "completely overcome" the "great difficulty" in the case. We copy these views from Mr. Gordon's book; and shall copy also from it the following explanatory details:

"Fig. 2 is a longitudinal section, with the blade or piston A in one part of its course (a lunette space). Fig. 3 is a cross section, showing the blade or piston A. Fig. 4 shows the piston in a different part of the lunette space; F is a fixed centre or axle, upon which the piston A turns—the radius sweeps round the inside of the larger circle D D; G is the *mathematical* centre (for there is no axis

through the centre of the inner cylinder C C C, &c.) around which the cylinder C C turns. The piston A works in a ball-cock or stuffing at B; and in traversing the lunette space formed between D D and C C C, is obliged to slide out and in through B. At one time this piston A will have a larger portion protruding from C C C, as in fig. 3; and at another time it will protrude less, as in fig. 5. At one time, in each revolution, A will be at a point where there is no part protruding. The piston *crawls* out of and into the cylinder C C C (through B) constantly. The steam from the boiler is admitted through the hole S, and rushes along the opening Y, in the direction of the small arrow: it cannot escape where the cylinders C and D are in contact, and therefore it forces round the piston A in a contrary direction. The other part of the lunette space *evacuates itself* in the direction of the double arrows. Of course the power of the engine is always varying, because the surface of the piston is always either increasing or diminishing. To compensate for *this* variation, two cylinders are used; the one to be in full activity, while the other is passing the dead point. As the one decreases the other increases; and thus a continuous and rotatory motion is maintained, which can be applied in every case where the reciprocating engine is used for rotatory purposes."

We cannot say that this description of Mr. Gordon's is very clear or intelligible; it is, in truth, extremely loose and confused—in some parts, indeed, nonsensical. However, such as it is, we must leave our readers to digest it as they best can. It has all the appearance of being done to order, like the encomiums we before quoted from the same pen; and it would be presumptuous in us to attempt to offer any thing in the way of explanation or emendation. The engravings, at least, are plain enough; and, with their help, the intelligent reader will, we dare say, be able to arrive at a tolerably clear notion of all that is meant by *mathematical centres*, *crawling pistons*, *spaces evacuating themselves*, &c. &c.

Mr. Gordon adds, that "by some recent alterations in the steam-ways, the patentee has been enabled to use two pistons in one cylinder, and thus to save weight to a still greater extent. By this new arrangement, one piston increases in power in proportion as the other diminishes in power."

Supposing the engine to be as efficient as it is represented to be, the following are, according to Lord Dundonald, the principal advantages to be expected from its adoption:

"1st. It will not occupy one-sixth part of the space required for the reciprocating engine.

"2d. It may be placed so low in a vessel as to be quite out of the reach of gunshot; or the cylinder may be made shot proof, without the slightest disadvantage.

"3d. The revolving engine does not require any valve or slide, consequently there is no waste of steam thereby; neither is there any loss, as in the space left at the top and bottom of the cylinders or reciprocating engines.

"4th. There is much less friction than arises from the sum of all the bearings required to convert the rectilineal force of the common engine to circular motion.

"5th. There are no beams, cranks, side rods, connecting rods, parallel motions, levers, slide valves, eccentrics, &c., with their nicely adjusted joints and bearings; therefore the revolving engine is not liable, even in one-tenth degree, to the accidents and hindrances of other engines.

"6th. The working of the revolving engine, in a steam-vessel, is much more pleasant to passengers, by the absence of tremor, now occasioned by the alternating of a ponderous mass of moving matter, twice in every stroke of the engine.

"7th. The revolving engine being contained within a cylinder, may be completely finished and united in the manufactory; and may be lowered into a vessel, and fixed in fewer days than weeks are now required to erect and adjust a reciprocating engine.

"8th. As the moving parts of the revolving engine pursue their course in perfect circles (without stop or hindrance) this engine is capable of progressive acceleration, until the work performed equals the pressure of steam on the vacuum, or on the atmosphere: an advantage which the reciprocating engine does not possess.

"9th. The revolving engine is com-

pletely under the control of the commander of a vessel, without the intervention of an engineer; simply by connecting a rod or line, from his usual station on deck, to a cock, by which he can set the engine going, stop, or reverse its motion.

"10th. The diminished bulk, weight, and absence of tremor, add to the capacity, buoyancy, velocity, and durability of vessels in which the revolving engine is placed.

"11th. This engine can, with equal aptitude, be constructed to propel the largest vessel, or the smallest boat; to pump the ship, weigh the anchor, embark or discharge the cargo, and perform the most laborious duties of a crew.

"12th. It is peculiarly adapted to locomotion on land; there being, in the revolving engine, no part requiring to be oiled,* exposed to the adhesion of dust or grit, now so destructive to the rods, joints, and bearings of locomotive engines.

"13th. The revolving engine, from the solidity of its parts, the simplicity of its construction, and the uniformity of its impulsive action, can be kept in repair at less expense than the reciprocating engine; and, if used for mines or manufactories, an engine-house is not required; a simple shed or covering being sufficient.

"Lastly. One quarter of the capacity of ordinary steam-vessels (or half the engine room) is restored to useful purposes; whilst the vessel can be navigated by the same number of engineers and seamen, and with the same consumption of fuel. Thus the comparative cost of building the *useful* portion of a steam-vessel, and the expenses of all kinds, are diminished one-third; whilst the profit from an increased amount of cargo or passengers, or the facility of proceeding to more distant parts, is in the like ratio augmented."

[From the Journal of the Franklin Institute.]

List of American Patents which issued in August, 1834, *with Remarks and Exemplifications by the Editor.*

1. For a Cooking Stove; Horace Bartlett, Carmel, Putnam county, New-York, August 1. The claim in this patent is to the "extending the bed of the fire so far back that it receives long wood, in such a way that only about one half of it is burning at the same time, unless the draft door is opened at the back, which may be done when more heat is required; thus putting in long wood, and leaving it perfectly under the control of the manager, consuming no more than what is required for immediate use, thereby saving the expense of cutting the wood into short pieces; thus acting somewhat like the principle of burning coal from the base, but applied to wood for a cooking stove."

2. For an Improvement in the Apparatus for Tanning; James R. Deniston, Connersville, Fayette county, Indiana, August 1. In the petition, it is stated that the improved apparatus "consists of a vat protected from freezing in the bark house, in which is manufactured ooze of every desirable quality, from which it is strained off into a general reservoir, from whence it is dispersed, as required, throughout the yard, or raised to an elevated vat, and then dispersed, all by means of pipes, so placed under ground as to prevent freezing. The hides are hung perpendicularly in the vats of the yard. By means of this improvement there is a vast saving of labor and bark; at least twice the usual expedition; and excellence in tanning is secured, and no weather prevents the usual operations of the yard."

3. For a Washing Machine; Avery B. Gates, Connersville, Fayette county, Indiana, August 1.

4. For an Improvement in the Mode of constructing the Roofs of Buildings, and a Composition for covering all Kinds of Roofs, Brick or Stone Walls, Boards and Timber, exposed to the Weather; Daniel A. Balcom, Northampton, Bucks county, Pennsylvania, August 1. The compound resinous cement, here patented, is composed of eight parts tar, four parts rosin, and twelve or fourteen parts of finely pulverized dry clay, which are to be mixed together, and boiled until all the water has evaporated. Care must be taken that the ingredients be so proportioned, heated, and incorporated, that the mixture shall not be liable to melt and run

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* "The offensive smell, so much complained of in steam-vessels, arising from the decomposition of grease and animal oils, spilt in lubricating the bearings of the numerous parts in motion, may be greatly diminished, and, with care, may be wholly avoided where the revolving engine is used."

by the action of solar heat, or to crack by its contraction from cold. The cement is to be laid on with a hot trowel, and all cracks and interstices must be carefully filled up. Among the purposes to which it is proposed to apply it, the coating of ships' bottoms, instead of copper sheathing, is mentioned.

5. For an Improvement in the Threshing Machine; John Marshall, Jr., Sweden, Monroe country, New-York, August 1. The so-called improvement is rather an appendage to the threshing machine, as it is intended to agitate and carry away the straw after it has been passed through the ordinary beaters. An endless apron is to be made by taking two long ropes to form its sides or edges, and from one to the other of these ropes, slats, or wires, are to extend, parallel to and within an inch or two of each other. This apron is to be stretched upon, and to pass over, rollers, and upon it the straw is to be delivered as it is threshed. It is to be of such length as to carry the straw out of the barn, and during its passage a beater is to strike upon it to agitate the straw, and shake out the last portions of the grain. It is to be moved by the same power which gives motion to the threshing machine.

6. For a Truss for the Cure of Hernia; Thomas Lawrence, Clarke county, Kentucky, August 4. A pad is to be made of wood, which may be round, and from two to five inches in diameter. The side intended to be worn next the body is to be convex, and the opposite side flat; this pad, or block, is to be perforated through its centre, to admit a wooden pin to slide in it, which pin has a head of such size as shall pass into, and bear upon, the ruptured cavity.

7. For a New Manufacture of Figured Fabrics; John Smith, Shaeffers-town, Lebanon county, Pennsylvania, August 4.

"To all whom it may concern, be it known, that I, John Smith, of Shaefferstown, Lebanon county, in the State of Pennsylvania, have invented a new manufacture of woven figured stuffs, such as carpeting, coverlids, table covers, and various other articles, either in single or mixed colors; and I do hereby declare that my said invention consists principally in the manner of preparing the chain to form the ground or basis of such articles, and that the following is a full and exact description thereof.

"I make the chain of the various articles which I manufacture, by taking two double and one single thread alternately; and in weaving the figures, the filling never floats over more than five threads; that is to say, over four double and one single thread, instead of over nine threads, as in the ordinary mode of weaving. The filling is also in part of single and in part of double thread, the single thread being employed to bind, or interweave with, the double thread of the chain; and the double thread of the filling, which is usually of woollen yarn, is bound by the single thread of the chain. By forming my patterns in this way, no part of the fabric is loose from, but is interlocked with, the pattern on the opposite side of the cloth, and a degree of firmness and distinctness of pattern is given, which cannot be attained by the use of a chain composed entirely either of double or of single threads, whilst, at the same time, each thread of the filling interweaving with one of the chain, at shorter intervals than in the ordinary mode of weaving, the article is rendered more durable, and the double thread of the filling being bound down by the single thread of the chain, the pattern formed by the double filling is left as distinct in its form and colors as in the more loose fabrics, in which the filling floats or passes over a greater number of threads.

"All the variety of patterns given to goods of this description may be produced in my mode of weaving, and although I have made some improvements in the loom which I use for the purpose, similar articles may be woven in the ordinary figure loom; I do not, therefore, describe or claim any particular machinery for effecting the object in view, but claim only the arrangement of the double and single threads in the chain, and in the filling, applied in the manner and for the purpose herein described. Although I have spoken of double and single threads, both in the chain and filling, it is to be understood that these denominations respect the size of the threads employed, rather than the mere fact of their being double, or single, as a double yarn may be employed in lieu of that which I denominate single, provided its

fineness was such as to produce the intended effect, and a fine double yarn thus used I should consider as interfering with my invention, as it would enable the weaver to produce a manufactured article essentially similar to that described."

8. For a Blacksmith's Striker; Joel Woodel, Jackson, Madison county, Tennessee, August 6.

9. For a Cast-iron Sink; Zenos Tarbon, Franklin, Delaware county, and Levi B. Tarbon, Oneonta, Otsego county, New-York, August 6. The description of this affair is so very brief that it would seem impossible to say any thing about it in fewer words than those used by the patentees, which are: "The sink is thirty inches in length, and twenty inches in width, with a soap dish in one corner, and a hole through the bottom to let off the water; all of which is made of pot-metal, and cast whole."

10. For improvements in the Construction of Bee Hives, and the Management of Bees; Levi H. Parish, Brighton, Monroe county, New-York, August 6. In the construction of the hives here recommended, there is nothing very peculiar; but they are to be large, and to be divided into separate compartments, by means of smaller boxes fitted into them, which boxes may be removed and replaced at proper periods. The main thing insisted upon is the advantage of keeping the hives within doors, in the upper rooms of a dwelling, or other suitable building. The benefits resulting from this are fully set forth, with much earnestness and good sense.

11. For an improvement in Weavers' Harness; J. Blackmar, Killingly, Windham county, Connecticut, August 7.

12. For an improvement in the Art of Manufacturing Nails; Freeman Palmer, Buffalo, Erie county, New-York. Patent first issued October 25th, 1832; surrendered and re-issued upon an amended specification, August 7.

13. For an improvement in the Construction of the Saw Mill; Thomas Blanchard, city of New-York, August 8. "The principle of this invention consists of the combination of a circular saw with a common saw mill log carriage, of any convenient construction."

14. For an improvement in the Mode of Manufacturing Butt Hinges; Dorwin Ellis, Attleborough, Bristol county, Massachusetts, August 8. This patent is taken for the process by which the hinges are manufactured, there being confessedly nothing new in the machinery, which, in the present case, is merely adapted to the purpose to which it is applied. Strips of metal, about twelve inches long, and of a proper width, are to be cast with a projecting ridge along their whole length, which ridge forms the knuckle or joint of the hinge. The strips or plates, so cast, are to be passed between rollers, having grooves in them corresponding to the ridge in the strips; by this means they are equalized, and are then to be placed in a screw or other press, where they are cut off and the joints formed. The blanks or halves are next to be fixed in a drilling machine of the usual construction, after which they are ready for the pins.

15. For an improvement in the single twist Screw Auger; Nathaniel C. Sanford, Meriden, New-Haven county, Connecticut, August 8.

16. For an improvement in the spiral Screw Auger; Alfred Newton, Meriden, New-Haven county, Connecticut, August 8. This, instead of a two, is to be a three lipped auger.

17. For a Fire Engine; Thomas A. Chandler, Norfolk, St. Lawrence county, New-York, August 8.

18. For an improvement in Machinery for Dying and Printing; James Rennie, Lodi, Bergen county, New-Jersey, August 8. The specification informs us, that the invention here claimed is "an improvement and combination of machinery for dying, stamping, or printing, two or more different colors, mordents, or shades, at one impression, which improvement and combination I denominate the *magic sieve*." This is followed by a transcript of the whole of the specification of the patent obtained by the same gentleman on the 9th of June, 1834, and before noticed; and this is succeeded by a description of the magic sieve, which consists of an extension and variation of the same principle or combination that was the subject of the former patent.

19. For a Churn; Joshua Ricker, Bangor, Penobscot county, Maine, August 9.

20. For a Composition of Matter applicable to the Construction of Roads, Streets, &c.; John Martineau, Elbridge, Onondaga county, New-York, August 11. The claim at the close of the specification of this patent will exhibit clearly the object for which it is obtained.

"What I claim as my invention and improvement, is the application of tar, turpentine, or any other of that class of cohesive substances, reduced before use to a fluid state, and in that state used as a cement to apply to, and combine with, sand, gravel, pebbles, pulverized stone, such as is used for a M'Adamized road, or cobble stones; the interstices of coarse materials being in all cases filled, as well as may be, with sand and gravel, and cemented with tar, or turpentine, to form the wearing surface of roads, streets, &c., in the manner described in this specification, however the same may be modified or varied in practice. I also claim the application of the before mentioned cohesive substances, combined with sand, or other material, to the lining of canals, raceways, flooms, reservoirs, cisterns, &c. &c. in all the varied forms which practice may suggest, however modified or varied."

21. For Hulling Clover Seed; Benjamin Wood, Doylestown, Bucks county, Pennsylvania, August 11. The clover is fed on to a sloping sifter, by the shaking of which it is to be separated from the straw; this sifter has a tight bottom, and above this a faise one, which is perforated with holes sufficiently large to admit the seed to pass through.

22. For a Heat Retaining Cooking Stove; John Moffit, Buffalo, Erie county, New-York, August 13. From what we can gather in the specification, the main object, in the view of the patentee, was to construct a stove, which should be surrounded by reflecting and non-conducting substances, forming an inner and outer case. For this purpose a wooden case is made, having its interior covered with sheet iron, which, however, is to be sustained at the distance of an inch and a quarter from the wood, the space between them being compactly filled with cotton. There must, of necessity, be a space of several inches between the case and the stove in all directions. To allow of a free play of heat within the case, the sides of the stove are, in part, constructed of vertical bars.

23. For a Fly Driver; R. H. Faunt Le Roy, New-Harmony, Posey county, Indiana, August 13. The fly driver is "intended to keep or scare away flies, moschettoes, and other insects, from beds, cradles, tables, and other places where said insects are troublesome, by means of fans, wings, brushes, curtains, or feathers, kept in motion by means of a machine, without the attention of any person."

24. For an improvement in Fire Proof Wrought Iron Chests, and in locks and fixtures therefor. First patented March 7th, 1826; patent surrendered and re-issued on an amended specification, August 13.

25. For a Press Tub, for pressing seeds, kernels, &c.; Francis Follett, Petersburg, Virginia, August 14. The principal improvement claimed in this patent is the mode in which the strainer is made that forms the bottom of the tub.

26. For a Cooking and Heating Stove; Samuel B. Sexton, Philadelphia, Aug. 14.

27. For an improvement in forming Bodies for Hats; William Nunns, city of New-York, August 14. Hair cloth, formed of horse, or other hair suitable for the purpose, and combined, if desired, with other filamentous substances, is to be formed into a body, and stiffened by any of the ordinary methods. The body so formed is intended principally as a foundation for silk hats, but it may be used with other material, or by itself, which use the patentee would consider as a part of the present invention.

28. For a Horse Power; John A. Pitts, and Hiram A. Pitts, the former of Brinthrop, Kennebeck county, the latter of Livermore, Oxford county, Maine, August 15. The improvement in the horse power claimed by the patentees, they denominate an "Endless chain and cog band."

29. For a machine for Doubling, Twisting, and Laying, Spun Tobacco; James Maurey, Petersburg, Virginia, August 15. This machine resembles, in its general construction, some of those used for doubling and twisting cordage, but so altered as to adapt it to perform the same operation upon tobacco, and thus to facilitate, in an important degree, the manufacture of twist.

30. For an improved Oven; Richard R. Tonge, Fryeburg, Oxford county, Maine, August 15.

31. For a Machine for Hatchelling Hemp, Flax, and Wool; Daniel Treadwell, Boston, Massachusetts, August 18.

32. For machinery for Tarring Rope-yarns; Daniel Treadwell, Boston, Massachusetts, August 18. The patentee states that his improvement consists in three distinct parts. First, in the method of heating the tar; second, in rubbing, or untwisting, the yarn, for the purpose of saturating it with tar; and third, in the nippers for pressing out the superabundant tar.

33. For an improvement in the art of Extracting the Precious Metals from their Ores; John L. Sullivan, city of New-York, August 18. It is our intention to give a full description of the apparatus which forms the subject of this patent; but knowing that the patentee intends to introduce further improvements in the mode of procedure pointed out by him in his specification, we will at present merely observe, that by the machinery employed, the ores of gold, and more especially auriferous iron pyrites, are to be exposed, when pulverised, to the united influence of heat and motion; the heat being principally supplied by a current of air, which will carry off the sulphur and other volatile matters, and thus leave the gold in a proper state to be separated from the ore by amalgamation, either in the same, or in an auxiliary instrument.

34. For a Threshing Machine; Isaac Gallop, Plainfield, Windham county, Connecticut, August 18.

35. For an improvement in Fire Ladders; James Lee Hannah, M. D., city of New-York, August 19. A ladder is to be made in the usual way, but having the two sides parallel to each other. The topmost round is to be a bar of iron, which is to project through the cheeks of the ladder, and is to have a round roller, or wheel, at each end, which, by their rolling upon the wall, are to facilitate the raising of it. The main ladder may be forty feet in length; but there are to be additional sections, each of from five to eight feet long, to be fastened on its bottom, when necessary; strong bolts at one end of these sectional pieces are to pass through staples at the lower end of the ladder.

36. For an improvement in instruments for Cutting and Crumbling the Stone in the Bladder; James Lee Hannah, M. D., city of New-York, August 19. These instruments for cutting and for crushing the stone, are, when closed, in the form of a sound or catheter, but considerably curved at the end which is to enter the bladder. According to the drawing, the shaft is straight, but the end is bent round so as to form a quarter of a circle of about three fourths of an inch radius. This quadrant constitutes the jaws by which the cutting and crushing are to be effected; these jaws work on a pin near the extreme end, and when closed form a round smooth body, having no projection to obstruct it in its entrance; its opening commences at the point where the curve terminates and joins the straight shaft. This straight shaft consists exteriorly of a thin silver tube, and through this tube passes a steel spring like a watch spring, which, when pushed in, allows the jaws to open, the spring being attached to the jointed piece. The cutting instrument has edges like shears, the crusher opens like forceps, and has teeth to hold and crush the particles of stone which have been divided by the cutter.

37. For a Machine for Grinding Grain; Joseph Grant, Providence, county of Providence, Rhode Island, August 19. This is to be a cast iron mill, consisting of three cylinders and a concave, all of which are to be so fluted as to form teeth not more than a quarter of an inch wide, and an eighth of an inch deep. Two of the cylinders, with a hopper above them, are to be placed horizontally and parallel to each other. The lower cylinder has a concave under it, which is adjustable by means of a screw. The cylinders are all to move with different velocities, the last with the greatest speed.

38. For a Threshing Machine; Chas. Wilson, city of New-York, August 19. This machine is to have a frame made entirely of cast iron, and the concave is to be formed entirely of triangular cast iron bars, about five eighths of an inch thick, and an inch apart, allowing space for the grain to fall through between them. The whole surface of the cylinder is also to be of cast iron, consisting

of bands or hoops, four or five inches wide, and a quarter of an inch thick, with projecting pieces for beaters cast on them. These bands are to be driven on to a wooden cylinder.

39. For an improvement in the Percussion Cannon Lock; Enoch Hidden, city of New-York, August 20.

40. For a Filtering Machine; Isaac Wiseman, city of New-York, an alien, who has resided two years in the United States, August 20. The principal difference between this and the filtering vessels ordinarily employed, consists, first in there being a separate vessel to receive the water which has been filtered, and which vessel can, therefore, be removed for the purpose of clearing it of the sediment which always finds its way into such reservoirs; and, secondly, in interposing between the layers of broken quartz, sand, charcoal, &c., perforated plates of earthen ware, metal, or other substances, which will prevent their mixing with each other from agitation in removal from place to place. Such perforated plates are not new.

41. For a Revolving Turning Steel; Benjamin E. Hoyt, Ipswich, Essex county, Massachusetts, August 20. This steel is for turning the edges of curriers', or other knives, by passing a roller instead of a burnisher over them.

42. For an improvement in the manufacture of Percussion Powder; Samuel Guthrie, Sacket's Harbor, Jefferson county, New-York, August 21.

43. For a machine for Separating Gold from the Soil; John Dobson, Burke county, North Carolina, August 21. This machine has an inclined rocker, similar to that used in many others, and various appendages which have no claim to novelty. After describing these, the patentee says: "although I have been particular in describing the construction of the above machine, yet I rest my claim only on those principles of the bucket or receiver, by which a peculiar rolling motion is given to the mercury, most applicable to the collection of the gold; which principles and advantages it may be necessary to mention as understood by me. In the first place, a larger quantity of mercury can be used than by the present mode, without danger of loss, and extending from side to side of the bucket, presenting a rolling edge to the approach of the gold, of sixteen inches in length.

44. For a Clover and Herdgrass Hulling Machine; Reuben Ranger, Wilton, Kennebeck county, Maine, August 21. The hulling is to be effected by rubbing the seeds between perforated plates of sheet iron, one portion of which is a conical body, and is made to revolve upon a shaft placed horizontally; this is surrounded by a concave similar in form, and surmounted by a hopper. The rubbed seeds pass out through an opening in one end of the machine, at the lower edge of the base of the cone.

45. For an improvement in Finishing Leghorn, Straw, Grass, and Palm Leaf Hats and Bonnets; Joseph Snyder, city of Philadelphia, August 22. The hats and bonnets are to be varnished with any of the known suitable varnishes, adapted to the color of the article.

"The object intended to be attained by the foregoing improvement is to preserve hats and bonnets from moisture, that they may retain their proper shape."

46. For an improvement in the Spinning of Rope and other Yarn; Sidney D. Whitlock, Brooklyn, Kings county, New-York, August 22. It is observed in the petition, that this patent is claimed for a "new application of the machine for which letters patent of the United States were granted to a certain Robert Graves of Boston, on the first day of April, 1819."

In the specification it is stated, that the original machine is modified by the use of a double railway for the machine, or machines, to run upon; using at each end of the double track, a detached section of the track, made to revolve like the turnabouts upon railroads, so as to accommodate the equalizing machine. "Each track is furnished with an endless band and rope, operating as described in the specification of the said Graves' machine herein referred to, alternately on the equalizing machines as they change tracks."

47. For an improvement in Shearing Machines for Shearing Woollen Cloth; Reuben Daniels, Woodstock, Windham county, Vermont. First patented May 13th, 1834. Patent surrendered and reissued on an amended specification, August 22.

48. For improvements in the Power Printing Press; Otis Tufts, Boston, Massachusetts, August 22. We are informed in this specification, that "the principal difference between this power press and others now in use consists in supplying it with paper to be printed from one side of the frame, by using two friskets, one of which is under the operation of an impression from the platten, while the sheet of paper last printed is being removed from the second frisket, and another sheet is applied. As soon as the frisket first mentioned has received an imprint from the types, it is withdrawn by the operation of the machinery from between the platten and form, and the second frisket caused to pass in between the platten and frame, there to be acted on in its turn. So in succession each passes out from between the platten and frame with its printed sheet, while the other, with the sheet to be printed, is made to pass in between the platten and frame."

49. For a Double Cylinder Truck, for Raising Stone, Timber, &c.; Simon Frieze, Waterloo, Anne Arundel county, Maryland, August 23.

This truck is to run up an inclined plane or railway formed of parallel timbers, rising at any angle not exceeding thirty degrees. Instead of four wheels, there are to be two rollers turning on gudgeons, one at each end of the truck. An offset is to be turned down at each end of the rollers, to form a shoulder, or flanch, to keep them in their places on the ways. The part turned down is to be champhered, to cause the truck to keep the track the more readily. At the upper end of the inclined plane there is to be a block with a rope passing over its sheave, one end of which rope is attached to the truck, and the other drawn by horses or other animals, to raise the load.

50. For a Machine for Hulling Clover and other small Seeds; Merit Baily, Attleborough, Bucks county, Pennsylvania, August 23.

51. For a Horse Power; Joseph B. Streeter, Middlesex, Yates county, New-York, August 26.

52. For Jointing and Manufacturing Staves for Barrels, &c.; Cyrus M'Gregor, Newport, Sullivan county, New-Hampshire, August 26.

53. For an improvement in the surgical instrument called a Scarificator; Geo. Tiemann, city of New-York, August 26. The improvement in the construction of the scarificator, which forms the subject of this patent, appears to us to deserve the appellation, as we think that, both in construction and in operation, it will be found superior to those made either in the English or the German manner. The patentee, after describing the usual mode of forming this instrument, informs us, that the principal improvements made by him are the use of pointed lancets, instead of those with rounded ends; a contrivance for using them with more exactness, and so as to cause less pain, and produce a more profuse bleeding than heretofore, whilst the mechanism is more compact, and more easily kept clean, and in order, than in the old instrument.

The lancets, instead of standing in rows upon an axis, or shaft, are all fixed upon a flat plate, which fits into a box, similar to those now in use, but smaller. For the purpose of moving the plates containing the lancets, an axis and jointed levers are placed under it, which are operated upon by suitable springs, and other appendages, that are fully described, and perfectly represented in the drawing. There is no distinct claim made, but the difference between this and other instruments for the same purpose is clearly designated, so as to leave no doubt whatever respecting the points upon which the dependence for originality is placed.

54. For Stoves for Burning Coal; Abial Smith, North Providence, Providence county, Rhode Island, August 27.

55. For a Threshing Machine; John Matthias, Manchester, Baltimore county, Maryland, August 27.

56. For a Bedstead for the Sick; Wm. Woolley, city of New-York, August 30. [For a description, with drawings, see p. 74, vol. iv., of Mechanics' Magazine.]

Origin of Telegraphic Language.—Agamemnon promised Clytemnestra that the very day that Troy was taken, he would give notice of the event by fires. Æschylus, the poet, has recorded in one of his tragedies the fact that he kept his word, for a female sentinel declares that she spent many weary nights before the blaze was discov-

ered. The Gauls made known the massacre of the Romans, in the lifetime of Cæsar, in the now city of Orleans, which took place at sunrise, as far as Auvergne by nine o'clock in the evening, the distance being one hundred and twenty miles, by shouting from one post to another.

Engraving in Relief.

To the Editor of the Mechanics' Magazine:

Sir,—Every well-wisher to the cultivation of the fine arts must have been gratified at observing the progress that has been made during the last few months in this elegant department of engraving. To me it is a matter of surprize, that it should be brought forward now as a new invention, when the fact must be known to almost every one, that a specimen was inserted in the "Journal of the Franklin Institute" so long ago as September, 1832. On reference to page 206 of the first volume of the Mechanics' Magazine, the following account is given of its introduction, accompanied with an engraving and a particular description of the machine.

The Journal of the Franklin Institute, for September last, contains an elegant engraved portrait of William Congreve, the Dramatist, executed by Mr. A. Spencer, of Philadelphia, in the manner described, and has inserted the following proofs that the invention can be claimed for America.

"Believing that the credit of the invention of a machine for medal ruling is due to America, we will briefly set forth our proofs, and then speak of the improvements which of late years the method has undergone.

"The proofs to be given of the existence and state of a machine are to be derived from the results produced by it.

"In 1817, by the use of a machine which had been invented in Philadelphia, Christian Gobrecht, die-sinker, produced upon copper an engraving from a medal, having upon it the head of Alexander of Russia; from this engraving impressions were taken and distributed. One of these impressions we have seen.

"In 1819, Asa Spencer, (now of the firm of Draper, Underwood, & Co., bank note engravers,) took with him to London a machine of the kind above alluded to, which was designed principally for straight and waved line ruling. This machine was used in London during the year just mentioned, and the mode of ruling waved lines, and of *copying medals*, was then exhibited and explained by Mr. Spencer to several artists, particularly to Mr. Turrell, who took, by permission, a drawing of the machine, for the purpose of having one made for his own use.

"Little, however, was done in the way of medal ruling until about three years since, when a desire to apply the method to the engravings of designs for bank notes caused it to be revived by Mr. Spencer, who bestowed great attention upon it, and overcame the difficulties met with in the outset.

"The peculiar construction of this machine has never been made a secret, nor has it ever been patented, although prudential motives have required that it should not be minutely described, and thus be placed in the hands of those by whom its use might be perverted. In consequence of this free communication in relation to this machine, it is now made with modifications in the details for engravers, by some of our machinists. We have lately had the pleasure of inspecting one of beautiful workmanship, made by Messrs. Tyler, Fletcher, & Co.

"The operations performed by this machine are the ruling of parallel straight lines at any required distances apart, and either continuous or broken; ruling converging straight lines; ruling waved lines, the waves being either similar or varying by more or less imperceptible gradations; and medal ruling, or transferring to copper the fac-simile of a medal, without injuring its surface, the waved lines presenting a copy of the minutest parts of the medal.

"Mr. Bate is said, in the extract which we have given, to be engaged in perfecting a machine for medal ruling: in his patent he claims the improvements on a machine for that purpose. It is impossible to say how far this latter claim may be borne out, since a description of the patented improvements has not yet reached us.

"That Mr. Spencer has essentially *perfected* this machine, as far as beauty of execution and fidelity of representation in the work to be done by it are con-

cerned, we do not hesitate to say; and that the public here, and our brethren of England, may be enabled to judge for themselves, we have obtained from Mr. Spencer a specimen* of medal ruling executed with his machine, an impression from which we give.

"The engraving is made from a copper medal placed in an embossed card of the ordinary kind. The surface of the medal bears not the slightest trace of injury from the machine, and even the yielding surface of the card is not roughened by it.

"An impression taken thus from a plate gives but a faint idea of the exquisite effect produced by engravings themselves made by this machine upon a polished surface of gold or silver.

"A series of the Napoleon medals, together with a portion of the series of medals struck in commemoration of the events of the first French revolution, attest the skill of Mr. Spencer."

It is with unfeigned surprise and regret, that I observe Mr. Ormsby, of this city, advertises himself as the inventor of the art. "Render unto Cæsar the things that are Cæsar's" is a rule the writer is always anxious to act up to, and he would be, indeed, glad to learn in what possible shape Mr. Ormsby can have any claim to be the inventor of the art. If he has any such claims, I have no doubt that your columns will be open for him to substantiate them; if not, he and all others who assume to themselves merit where none is due, should be made to feel, experimentally, that the real inventors may, with some justice, apply the language of the immortal bard to them, when he says,

> "He that filches from me my good name,
> Robs me of that which not enriches him,
> But makes me poor indeed."

J. K.

New-York, March 16, 1835.

Brick Machine.—We have received a letter from Mr. Harkness, saying that the title we gave to the brick machine, viz. "Harkness' Patent Brick Machine," is erroneous, and desires us to publish the following extract from his pamphlet, which we do.

"The machine described in the succeeding pages is a *new* invention, for which a patent will be obtained in the course of a short time, either in the name of Nathan Sawyer, or in the name of Mr. Sawyer, Mr. Freelove, and myself. The application of the straightening joint to the pressing of bricks, and the use of the crank, was, I believe, first suggested by Mr. Sawyer. The general details of the machine, set forth in the annexed pamphlet, are, with the above exceptions, strictly my own."

He also desires us to say, "that the patent about to be issued will be in the name of Nathan Sawyer alone."

Steam Carriages in Dublin.—We learn, from the Dublin papers, that a "Hibernian Steam Coach Company" has been established, for the running of steam carriages on the common roads; and that one of their carriages, called the "Erin," is to be seen almost daily traversing one or other of the streets of Dublin. "The Directors," says *Stewart's Telegraph Dispatch* of Monday last, "very prudently never gave any previous notice of their route, or the hour; still the crowds are tremendous. The Erin, on Saturday, left the station at Clontarf with a large party of ladies and gentlemen, at one o'clock, going by Ballyhough and Annesley bridges, through Abbey-street, Grafton-street, Nassau-street, and Dawson-street, to Stephen's Green, round which it went three times, at the rate of 18 miles an hour. It then returned to the station-house in Great Brunswick-street, where, having taken in a supply of water, it proceeded to Sackville-street, at the time crowded with vehicles of every description; this street it traversed repeatedly, showing the perfect control the steersman has over the vehicle: he turned a dozen times in a shorter space than any carriage drawn by horses would have ventured. After going round Mountjoy square, and the other leading streets on the north side of the city, the carriage returned to the station at Clontarf. The total absence of horse or smoke, and the little notice taken by horses, is most extraordinary." The carriage here spoken of was built, we believe, for the Hibernian Company, by Mr. W. Hancock, who has himself gone over to Dublin to assist in the introduction of steam travelling on common roads into the sister kingdom.—[London Mechanics' Magazine.]

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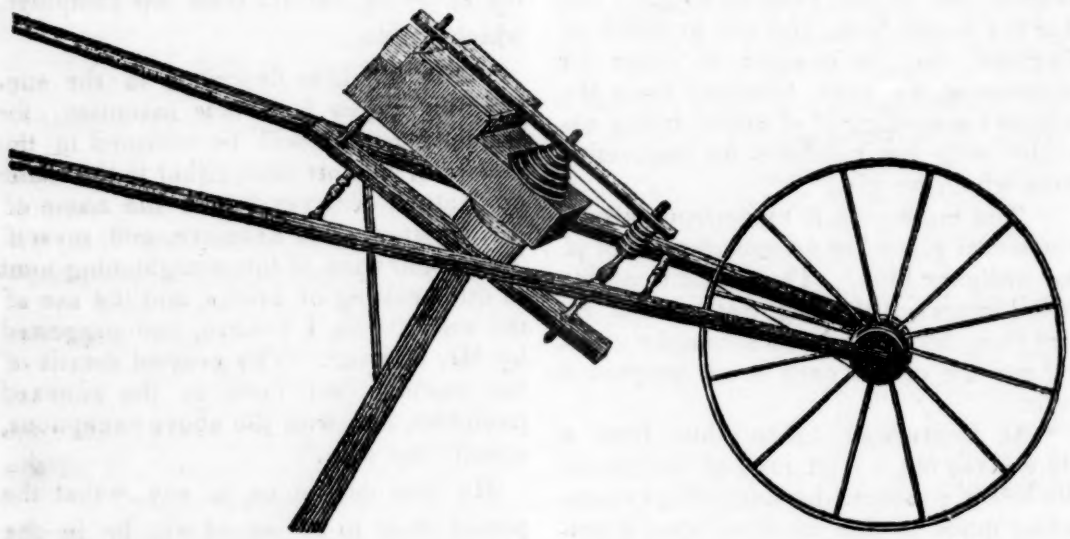
* "Various specimens of this work have been long since sent to London, and may be found in the possession of Messrs. Perkins and Heath, and of other artists."



MACHINE FOR PLANTING CORN, &C.

To the Editor, &c.

Sir: I send you herewith a drawing of a machine for planting corn and other round or oval formed seeds of any size, which was exhibited at the meeting of the New-York Agricultural Society, held at Albany on the 5th of February last, by Mr. Daniel Buck, of Lowville, in Lewis county, which I think is as important an improvement in the apparatus of husbandry as any article I have seen of its cast. The machine was patented, as appears by the specification which Mr. B. politely favored me with the privilege of copying, between six and seven years since; and the inventor, who Mr. B. states is a very ingenious and worthy young man, in the fulness of his confidence, made a large number of the machines; but before he had offered them to the public, the building in which they were deposited took fire and was burnt, and the machines with it, except two or three. Youthful genius is seldom calculated, though often doomed, to bear misfortunes; and so it happened here, for the young man was discouraged and abandoned the project, and had it not been for Mr. Buck, it would probably have gone untried to oblivion. He took one of the machines which escaped the fire, and has used it ever since in planting corn, ruta bagas, and other similar seeds, and finds it of such importance that he could not now be persuaded to dispense with it; and as his farming is on quite an extensive scale, it cannot, I think, need any further recommendation. Mr. B. says it is an easy task to plant an acre of corn in two hours; and that the improved manner in which the work is done, is of much greater importance than the saving of time, as the corn is not only planted with much greater accuracy—the number of kernels, distance of the hills, and depth at which deposited, being always uniform—but the seed being uniformly enclosed in moist earth, the germination is immediate and simultaneous. Mr. B. is confident, from his experience, that the additional yield in a field of less than 10 acres, either in corn or ruta bagas, will pay for the machine. It will deposite the seeds at any distance required, from one inch to any number of feet, and either single or any number required.

The machines are now making at Waterford, and will be ready for sale in season for the spring planting. S. B.

Lansingburgh, March 2, 1835.

Naval Ingenuity.—His Majesty William IV. has a *yacht* constructed, which can be taken to pieces and put together, like a Chinese puzzle. It is just finished at Sheerness, and ten shipwrights are gone to put it up on Virginia Water, in Windsor Park. These ingenious devices to pamper monarchs are turned to a useful account, when applied, as they are in this country, for the benefit of the people at large—thus, in hewing out and adjusting to each other blocks of granite, in the quarries of New Hampshire and Massa-

chusetts, for hospitals, court-houses, &c., to be put together in New Orleans, or other distant places.—[Scientific Tracts.]

Circulation in Animals and Plants. —We extract the following useful enumeration of all the *microscopic* objects in the animal and vegetable kingdoms, in which a vital circulation has been hitherto observed, from a new work which Mr. Pritchard, the eminent cultivator of this branch of science, has in the press, entitled, "List of Microscopic Objects:"

"The most interesting active phenomenon exhibited by the microscope is the circulation of the nutritious fluids in animals and plants. In the former, the globules of blood may be seen passing rapidly along the capillary ends of the arteries into those of the veins, when the intervening membrane is sufficiently diaphonous, as in the ear of the young mouse, the fins and tail of the carp, gold fish, stickleback, tadpole, and of most small fish, and in the web between the toes of the frog, lizard, eft, &c. For these purposes, a magnifying power from 100 to 250 times linear is sufficient.

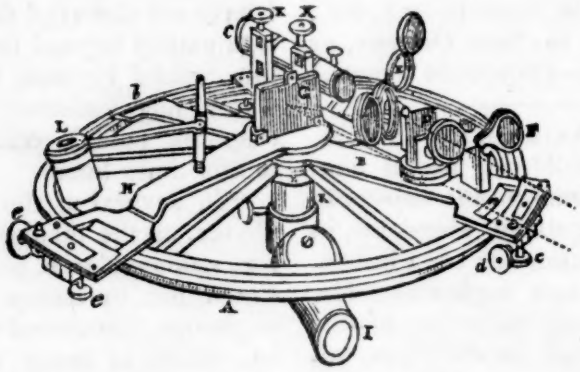
"In the arachnoida, (spider tribe,) at the joints of the legs, I have observed the circulation very distinct, the current of dark globules passing rapidly at each pulsation of the dorsal vessel. In the antennæ and wings of terrestrial insects, it has also been seen when they have just emerged from the chrysallis, as in the peria viridis and semblis billineata. In several aquatic larvæ and small crustacea, the circulating fluid traverses the limbs, antennæ, and tail, and thence moves along the dorsal vessel towards the head, and down the sides of the body in cavities, and not distinct vessels, hence called *diffused* circulation. The most favorable subjects for viewing this are the following, the first six of which are drawn and described in the *Microscopic Illustrations and Cabinet:* Larva of the ephemera, (the recent discovery of the beautiful mechanism of the dorsal vessel of this larva, by Mr. Bowerbank, is fully confirmed by the careful dissections of Mr. Newport, who with much perseverance has extended these inquiries to the other states of insects—see *Roget's Physiology*;) larva of hydrophilus, small disticus, agrion puella (in this elegant larva I have not observed the circulation in the legs extend beyond the haunches); libellula, round lynceus, fresh-water shrimp, water hog (oniscus); ligia, water flea (daphnia pulex), &c. Power from 100 to 250 times linear.

"In several of the polypiferous zoophytes, as the tubularia indivisa, sertulariæ, campanulariæ, plumulariæ, &c., Mr. Lister has by means of the achromatic engiscope, discovered a circulation to exist, which in many respects resembles that in plants.—See *Phil. Trans.*

"The circulation in plants, termed *cyclosis*, is a revolution of the fluid contained in each cellule, and is distinct from those surrounding it. It can be observed in all plants in which the circulating fluid contains particles of a different refractive power or intensity, and the cellules of sufficient size and transparency. Hence, all lactescent plants, or those having a milky juice, with the other conditions, exhibit this phenomenon. The following aquatic plants are generally transparent enough to show the circulation in every part of them: Nitelli hyalina, nitella translucent, chara vulgaris, and caulinia frigalis. In the frog-bit (hydrocharis) it is best seen in the stipulæ of the leaves and the ends of the roots. The magnifying powers suited for the above are between 100 and 250 times linear. In the spider-wort (tradescantia virginia) it is seen in the filaments surrounding the stamens of the flower: power 300 to 500 times linear. In the common groundsel (senecio vulgaris) it is said to be seen in the hairs surrounding the stalks and flowers."

Repeating or Reflecting Circle. —An instrument for measuring angles to a very great degree of accuracy. It was invented by Mayer of Gottingen, principally with a view to do away the errors of the divisions in the smaller instruments; and has since been much improved by the Chevalier de Borda, M. J. H. de Magellan, and Mr. Allan. The improved instrument, as it is constructed by the latter of these gentlemen, is delineated in the accompanying view.

Mr. Allan was rewarded by the Society of Arts for his improvements. The first of these is in the mode of applying the dark glasses, which are fixed on joints,



so as to turn back out of the way, in the same manner as in the sextant. In the old instrument these glasses were fitted into sockets provided with tenons on the indexes, and fastened by a milled head screw, which took much time to change them; the second is the addition of double verniers to the index, carrying the telescope and horizon glass; these read upon opposite sides of the circle, and, if a difference is observed between these readings, by taking the mean of them the error, arising from any eccentricity the index may have, will be corrected; and the third consists in fixing the index glass upon an axis, accurately fitted into the centre of the circle; by this means it is assured that the index glass in turning round shall always be exactly perpendicular to the plane of the circle; in the old method, when the index-bar was merely fitted on a pin fixed in the centre of the circle, it was impossible to make the circle so perfectly flat, or keep the index so accurately in contact with it as by having an axis. To explain these improvements more perfectly we must refer to the engraving, which contains a perspective view of the instrument. A is the circle with six arms; B is the index carrying the telescope C, and the horizon-glass, with the two clusters of dark glasses E and F; at the opposite ends of this index are the two verniers *a* and *b:* the former has the clamp screw and slow movement attached to it, consisting of a screw *c*, which fixed the index to the circle; and *d* is the tangent screw, which will move the index a small quantity when turned, to adjust it accurately. G is the index mirror screwed upon the index H, which has also a vernier, and a clamp and tangent screw *e e*, similar to the other. I is the handle by which the instrument is held when in use; it is fitted to a socket K, which is screwed to the centre of the circle, and is unscrewed from the circle when packed away. The handle is fitted to a springing socket, so as to turn round upon the socket K, that it may be turned to any side of the circle for the convenience of holding it; it may be fastened by a small milled nut, seen in the figure, which binds the ends of the spring socket together. L is a magnifying-glass, for the purpose of reading the divisions of the verniers; it is fitted upon a pin screwed into the indexes, and may be applied to either.

The telescope C is fixed to the index by two cocks and by two screws, X, X; in these it can be raised up or lowered, to adjust the different brightness of the two objects seen in the horizon-glass, the one reflected from the central mirror G, and the other seen directly through it. The dark glasses at E are intended to moderate the light of the sun, in passing from the index to the horizon-glasses. The frames containing these glasses have holes through them, to see through the telescope and horizon-glass; the other dark glasses F are situated behind the horizon-glass, and may be turned up or down as occasion requires.

The instrument is used in the same manner as the common reflecting circle, the angle being first taken on one side of the glasses, and then on the other, so that the angle is doubled; then it is repeated on a fresh part of the circle as many times as the observer thinks proper, and the product divided by the number of observations taken. The same term is also occasionally applied to another and very complicated astronomical instrument for nearly similar purposes, now but little employed.—[Partington.]

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, &c.

[Continued from page 135.]

VOCABULARY OF TECHNICAL TERMS NOT ALREADY EXPRESSED.

Abbey—a religious edifice.

Abrevoirs—the seams between stones and bricks in laying them.

Abutments—those portions of a superstructure (particularly a bridge) upon which any other parts rest.

Acroters—sharp and spiry battlements, or pinnacles, with rails and balustres, upon flat buildings; also pedestals upon the corners and middle of pediments, to support statues.

Alabaster—soft marble.

Alcove—a recess in a room for a bed of state; also an arched building in a garden, &c.

Alms-house—a building of charity.

Alto-relievo—figures raised high from the surface.

Amphitheatre—an edifice of an oval or circular form, with rows of seats rising one above the other.

Annulets—small circles or rings around columns.

Anti-chamber—a room that leads to the principal apartments.

Apertures—openings, as doors, windows, &c.

Apotheoses—applied in sculpture—deification.

Arabasques—ornaments.

Arcade—a walk arched over.

Arches, triumphal—erected to commemorate some important achievement.

Architect—a professor of the art of building.

Archivolt—a great span or arch.

Archway—the area beneath an arch.

Area—an open space.

Audit—in engineering, the mouth or entrance of an excavation.

Arena—the centre of the amphitheatre where prizes were fought by gladiators, so called, being strewed with sand to drink up the blood; a court of pleading.

Arrises—angles of sinkings, rustics, &c.

Ashlar—freestone taken rough from the quarry.

Ashlering—quartering in garrets, between the ties and principals; cradling of the angles of the roof.

Asylum—an edifice appropriated for the destitute.

Athenæum—a public building for discussion, &c.

Athletæ—figures of champions introduced into architecture.

Axe—a tool to chop with.

Bagnio—a house for bathing and sweating.

Balcony—a projection beyond a wall or building, supported by columns.

Balcony basket—a small iron balcony.

Baldoquin—a part of the altar.

Balk—a large piece of timber.

Balneary—a bathing room.

Bandelet—any flat moulding or fillet.

Banqueting Hall, or Chamber—a room appropriated for festivals.

Barge-course—the tiling which projects over the gable end.

Barn—a building for corn, &c.

Barrier—a boundary; a barricado.

Basilea—a large hall.

Basso-relievo—low sculpture.

Bastion—a bulwark or rampart.

Batten—a rod; also narrow slips and deals.

Battery—the raised work on which cannons are mounted.

Bearing—the distance-beams, &c. which rest on the wall.

Belfry—that portion of the tower or steeple set apart for the bells.

Bell-mouthed—Bells, as water-trunks, having large mouths.

Bench—at which a carpenter works; also a seat.

Bevel—a square used by masons, &c.

Binding joists—those in any floor into which the trimmers are framed, also the joists framed into the girders to support the floor.

Block—a large piece of marble or stone, as hewn from the quarry.

Blocking course—in masonry, a course of stones laid on the top for the crowning the walls.

Boulevards—ramparts forming promenades, as at Paris.

Border—pieces of deal round the hearth stone.

Bossage—any stone with a projection.

Bossages, vermiculated—such stones inlaid.

Boudoir—a small apartment allotted for ladies.
Boultine—a moulding whose convexity is one fourth of a circle.
Boxes—the principal seats in theatres.
Brace—a piece of timber framed, bevelling to roofs, partillions, &c.
Breastwork—work thrown up as high as the breast.
Bridging joists—the joists which are upon, and are supported by, the binding joists.
Bricklayer—a mason.
Butment—that which supports the foot of an arch.
Butts—thick ends of timber; also iron and brass hinges.
Building—a fabric.
Campanile—the roof of a tower in the shape of a bell.
Cantilivers—brackets supporting balconies.
Cap, or capping—an uppermost moulding.
Cartoons—paintings upon large paper.
Cartouses—modillions.
Casement—a hollow moulding one sixth or one fourth of a circle; also the opening iron frame of a window.
Casings—boards round doorways, &c.
Castle—a fortified building of ancient date.
Catacombs—subterraneous cavities for the burial of the dead.
Cathedral—the head church of a diocese.
Cellar—the basement story.
Cemetry—a burial place.
Cenotaph—an honorary empty tomb.
Centre-bit—a joiner's tool.
Chambers—the several sleeping rooms.
Chapel of Ease—a small chapel.
Chaplet—a moulding carved into beads.
Chapter—the head of a pillar or column.
Chaptrel—the capitals of piers which support arches.
Charnel-house—a place for the receptacle of bones.
Chateau—a country seat.
Cheveaux-de-frise—a fence for a turnpike, &c.
Chimney-pots—the tops of chimneys.
Chine—the back of a piece of timber.
Chipped—any thing defaced.
Chisel—a mechanic's tool.
Chock—a piece of noth timber fitted together.
Cincture—a band.
Circus—an open place for sport.
Cistern—a receptacle for water.
Citadel—a fortress, a castle.
Clamps—brick-kilns; also pieces at the ends of tables, dresser-boards, &c.
Clinkers—bricks run together by irregular burning.
College—a building in which collegians reside, of which there are several in the Universities.
Colonnade—a peristyle of a circular figure; range of pillars or columns.
Conge d'elire—a moulding.
Conservatory—a place where any thing is kept; a greenhouse.
Coping—the top of a wall.
Corridor—a covered way round buildings.
Cottage ornee—a fanciful cottage.
Counterscarp—that side of the ditch next the camp.
Countersunk—indented.
Court—a paved area in front or back of a building.
Courts—public places of law.
Coussinet—the stone which crowns a pier, or that lies immediately over the capital of the impost, and under the sweep. The bed is level below, and curved above, receiving the first rise of the arch or vault.
Coves, or Coving—stones, or iron, placed against the sides and backs of chimneys; also the angular parts of the roof when finished by a collar.
Crescent—buildings forming a curve, as at Regent's Park.
Cross garnets—long hinges for doors.
Crown of an arch—the head of it.
Crown-works—bulwarks advanced in the field to gain some rising ground.
Cupola—a dome.
Curb-stone—thick stone running by the side of pavement.
Curtail—the sweep of the rail of a staircase.
Dairy—a room for milk in a farm-house.
Dining-room—that which is appropriated for dinner.
Dome—a spherical roof raised on the middle of a building by way of crowning, as St. Paul's, sometimes of a polygonal form.
Dormant window—a blind or blank window.
Dormitory—a sleeping chamber.
Double-faced—presenting two faces at architraves.

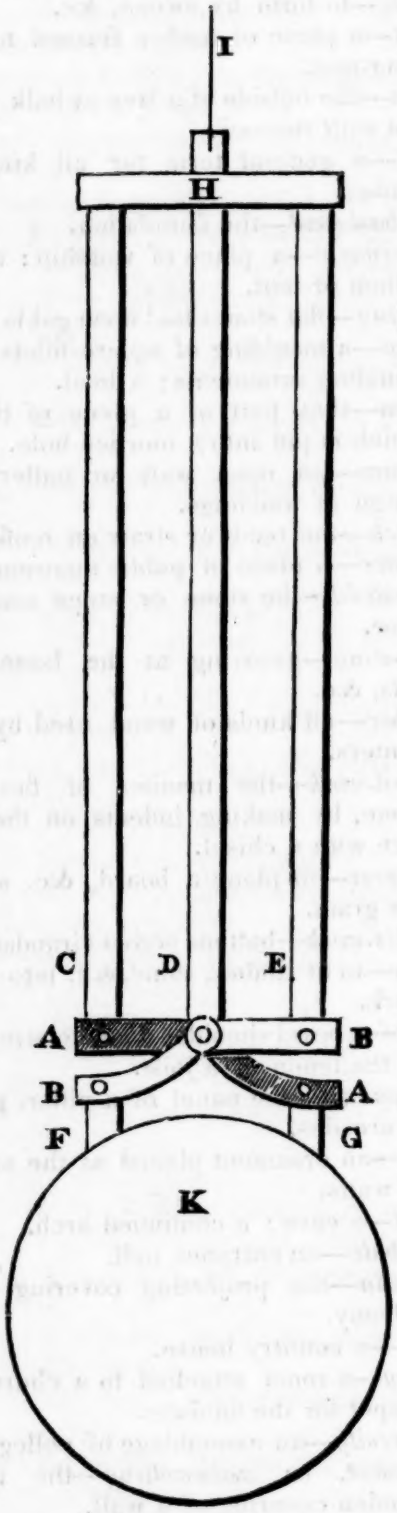
Dove-tail—a joint made by joiners and masons resembling the tail of a dove.
Dowels—cylindrical pieces of wood used in uniting floors, &c.
Drag—as a door when hanging on the floor.
Drawing-room—a room to which the company withdraw after dinner.
Dress—to prepare stone.
Dressings—the architraves, mouldings, &c. of a door.
Drill—to bore holes.
Eaves—the margin of the roof of a building, projecting beyond the wall.
Echinus—a member or ornament near the bottom of the Ionic, Corinthian, and Composite capitals.
Edifice—a building; a term principally applied to churches, abbeys, &c.
Embossing—the projection of figures from the plane upon which they are sculptured or engraved, called *bass-relief*, *mean-relief*, or *high-relief*, according to the protuberance of the figures.
Embrasure—a hold or aperture in a parapet for cannon.
Entre sol—a low room between two floors.
Enrichments—ornamented cornices or mouldings.
En grisaille—an aperture or moulding, done in black and white.
Episcopal chapel—a chapel vested in a bishopric.
Esplanade—the space between the glacis of a citadel and the first houses of the town.
Exchange—a building for the assembly of merchants, &c.
Eye—the middle of an Ionic volute or scroll in the form of a rose.
Fabric—a church, castle, &c.
Facade—the inclosure in front of a building.
Face—the outside of a fortress.
Fasces—ornaments of rods.
Fascines—faggots of small wood, six feet long, used in field fortification.
Feather-edged—thinner at one edge than the other.
Fell—to cut or hew down.
Festoon—an ornament of carved or plastic work.
Fire-place—where the fire is made.
Flank—the side of a building; flanks of a bastion consist of that part which joins the face or curtain.
Flanched—the returned ends of capping.
Flooring, naked—simply the girders, joists, trimmers, &c.
Flush—anything even or smooth.
Fort—a castle encompassed with a moat, rampart, and parapet, commanding a river.
Fret-work—ornamental carved work in continued squares.
Friary—a monastery; a convent.
Friezes in cameos—painted and figured friezes.
Furring—pieces affixed to joists or rafters, to strengthen or fill out.
Gabion—a basket open at both ends, with stakes used in parapets, in winches, &c. to protect the men.
Gable-end—the triangular end of a house.
Gallery—a walk along the floor of a house, outside; seats in a theatre or church; also a long room appropriated for pictures.
Gates—the entrance doors to parks, citadels, &c.
Girt—the circumference of timber.
Glacis—a mass of earth serving as a parapet.
Gorge—the entrance of the platform of any work; the neck of the Tuscan capitals.
Gouge—a carpenter's chisel.
Granary—a stone building.
Griffins—ornaments used in friezes, fabulous, as partaking of lion and eagle.
Groins—the circular or elliptical parts of the roof.
Grotto—a cave.
Grouted—mortar, &c. well mixed up.
Guillochi, or gollos—waved work in enrichments.
Hall—a manor-house; a college; also the entrance room of a house.
Hammer-dressed—stone worked rough with the hammer.
Haunches, or Hances—the ends or bases of elliptical arches.
Headings—the bordering of arches, hearths, &c.
Heel—an inverted ogee; a talon.
Helices—the spiral ornaments in the capital.
Hinges—appendages to doors, &c.
Hospital—a building for invalids.
House—a habitation.
Hotel—a building erected for the accommodation of visitors, &c.
Housings—the enclosure of the ends of stairs, &c.

Horn-work—outwork, composed of demi or half bastions, joined by a curtain.
In-fresco—painting on walls.
Inn—same as hotel.
Infirmary—a building for the sick.
Jail, or Goal—a prison.
Joggled—united together by tenons and mortices.
Jet d'eau—a fountain.
Kerf—the aperture made by a saw.
Kitchen—a room for culinary purposes.
Labyrinth—a place with inextricable windings.
Landing—the top of a staircase at each floor.
Larmier—the utmost projection of a cornice.
Lattice work—battens crossed to window-frames.
Leads—a term applied to flat-roofed leaded houses.
Ledger—same as putlocks.
Library—a room appropriated for books; a large building.
Lobby—an anti-chamber; also the large room of a theatre.
Lodge—the small building at an entrance gate in parks.
Mallet—a wooden hammer.
Mansion house—a large edifice.
Mausoleum—a receptacle for the dead.
Medallion—an ornament.
Member—any part of an integral
Metaches—ornaments.
Minaret—a spire.
Mint—a building appropriated for coining money.
Minster—a cathedral church.
Mitre—a bevel joint.
Monastery—a convent.
Monument—a building erected to commemorate some illustrious personage, remarkable event, or great achievement.
Mortice—a hole cut into timber or stone, to admit a tenon.
Mosaic-work—inlaid with pebbles, shells, &c.
Mosque—a place of heathen worship.
Mound—a heap.
Muniment—fortification; also a room in cathedrals for depositing the sacramental plate, &c.
Museum—a building for the depository of arts, &c.
Nunnery—a convent for nuns.
Obelisk—a quadrangular pyramid.
Observatory—a place for astronomical observations.
Openings—the apertures.
Oratory—a chamber set apart for prayer.
Orchestra—a music gallery.
Orlo—a fillet under the ovolo.
Ornaments—the sculpture or carved work of architecture.
Out-works—raised without the ditch of a fortified place, to cover and defend it.
Palisade—a fence.
Pantry—a room for provisions.
Parlor—a room in monasteries for religious conversation; a sitting room.
Parterre—a level division of ground in front.
Passage—an entrance lobby.
Pateras—the square ornaments in chimney pieces.
Pavement—stone flooring.
Pavilion—a princely residence after the Chinese fashion.
Perquetting—a floor composed of several figures.
Peristylum—a place begirt with pillars.
Perron—a flight of steps leading to the front door of a large building, when the floor of the lower story is raised a little above the ground.
Penitentiary—a place for penance; a building for the reception of unfortunate females.
Piazza—a portico.
Pile—a piece of timber driven into the ground for foundations.
Pillar—a shaft.
Pit—the area of a theatre.
Pitch—the elevation of a roof.
Planceer—a small shelf.
Plane—a carpenter's tool; a surface.
Platform—any horizontal plane; an elevation of earth, &c. for cannon, on which is a rampart; a stage.
Plugs—Wedges.
Plumb—upright.
Portals—the decorative parts of a gate or church.
Portcullis—a gate of a citadel.
Post—a piece of timber placed in a perpendicular direction.
Prickpost—that which is placed between two principal posts.
Priory—a convent inferior to an abbey.
Project—projecture; the prominency or embossment of mouldings.
Pulvinata—a frieze swelling out like a pillow.

Punchin—a short piece of timber.
Quadrangle—a court.
Quadrant—the fourth part of a circle.
Quirk—a round moulding.
Ravelin—a triangular work raised before a curtin, on the counterscarp of a place, for covering it and the adjoining flanks.
Rebate—a joint.
Redoubt—a small square fort, without any defence but in front, used in trenches, &c.
Refectory—an eating room.
Reglet—a small fillet.
Runs—signifying lineal measure.
Rustics, or Rusticating (*bevel*)—angular longitudinal cinctures between the joints of stones.
Ramp—a spring of an arch.
Rotunda—a circular building.
Rubbed—smooth-faced.
Rubble—broken stone.
Sabots—ornaments in sculpture.
Saddle-back—coping with a convex surface.
Saloon—a spacious hall or room.
Saxoned—jointed.
Scantling—breadth and thickness of timber.
Scheme of an arch—the bevelling joint.
Schools—higher places of instruction at Universities.
Scribe—to fit one piece of stuff to another, marking the same with compasses; also a mason's tool.
Scriming—sifting earth, &c.
Sculpture—the art of carving wood, stone, &c.
Seasoned—dried; fit for use.
Sewer—a passage for water to run through.
Shaky—timber, plank, &c. affected by the sun or weather.
Shoe—to abut in an angular form.
Shoulder—the butments of a tenon; a support.
Sinkings—grooves.
Skylight—a window in the roof.
Sluice—a water-gate.
Sole—the stone upon which window jaumbs are placed.
Span—the chord-line of an arch, applied to bridges, roofs, &c.
Spurs—timber placed angularly to support the heels of posts.
Square—as applied to ranges of buildings, forming a square.
Stage—a platform for theatres.
Standards—upright pieces of wood.
Stories—the several flights of rooms.
Strike—to form by sweep, &c.
Strut—a piece of timber framed to the king-post.
Stabs—the outside of a tree or balk when cut with the saw.
Stuff—a general term for all kinds of timber.
Sub-basement—the foundation.
Tabernacle—a place of worship; a pavillion or tent.
Tabling—flat stones laid upon gable ends.
Talon—a moulding of square fillets; terminating ornaments; a heel.
Tenon—that part of a piece of timber which is put into a mortice hole.
Terrace—an open walk or gallery; a range of buildings.
Thatch—the reeds or straw on roofs.
Theatre—a place of public amusement.
Threshold—the stone or steps under a door.
Throating—grooving at the bottom of sills, &c.
Timber—all kinds of wood used by carpenters.
Tooled-work—the manner of finishing stone, by making indents on the surface with a chisel.
Traverse—to plane a board, &c. across the grain.
Trellis-work—battens across virandas, &c.
Trim—to fit timber, stone, &c. into other work.
Tusk—a bevel shoulder made to strengthen the tenon of a joist.
Tympanum—the panel of a pillar, gates, or arcades.
Vase—an ornament placed at the angles of walls.
Vault—a cave; a continued arch.
Vestibule—an entrance hall.
Viranda—the projecting covering of a balcony.
Villa—a country house.
Vestry—a room attached to a church or chapel for the minister.
University—an assemblage of colleges.
Wainscot, or wainscotting—the inner wooden covering of a wall.
Water-board—a board railed to the bottom of a door.
Water-shoot—a trough placed under the eaves of a house to receive the water.
Water-trunk—connected with the shoots to convey the water off.

[From the London Mechanics' Magazine.]

COMPENSATING-PENDULUM.



Sir,—Annexed is a sketch of a compensating-pendulum, the idea of which was suggested by the description of a lever-pendulum, by Captain Forman, R. N., in your Magazine for last month.

The inconvenience of that proposed by Captain Forman, is apparent from a single glance; it is, in fact, of such a form, as to be rendered practically useless. The idea, however, of two bars of expansive powers in a duplicate ratio, acting upon a lever, to produce the effect required, is extremely ingenious; and availing myself of this hint, I propose to accomplish the same effect by means of *two levers*, so disposed that the form of the gridiron-pendulum will obtain without its complicated mechanism, and the pendulum be practically useful.

Trusting that the proposed plan may not be thought uninteresting, or unworthy a place in a work which has been so extensively useful to the artisan and mechanic, I beg to submit it to the consideration of your readers.

I am, Sir, your obedient servant,

BENJAMIN HURLEY.

Plymouth, Nov. 13, 1834.

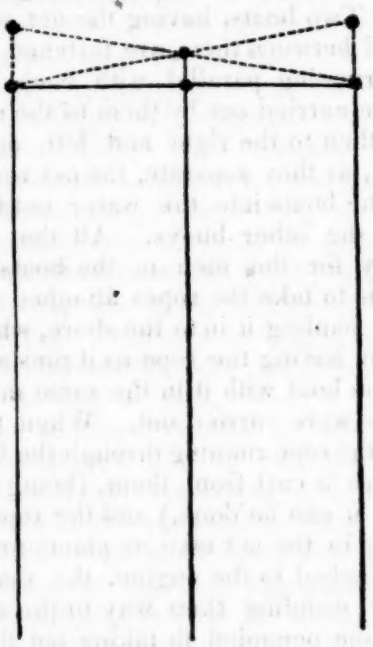
Description.—AA, BB, are two levers, with equal arms, (in the sketch they are drawn bent, in order to show both.) The lever AA (shaded) is attached at one end to the rod C, and at the other end to the rod G, which connects it to the pendulum-bob K. The lever BB is, in like manner, attached to the rod E, and the connecting-rod F. The pendulum-rod D passes between the two levers at their centres, and a pin passing through all three, (*i. e.*, the two levers and the rod,) connects them together, and thus fulcrums are formed for the levers. The pins in this case, as well as at the ends of the levers, should be fitted so as to admit of an easy motion upon them. The upper ends of the three rods are firmly fixed to the cross-bar H, and the pendulum swings in the usual way by the watch-spring I.

The rods C and E are made of metal, composed of 8 parts zinc and 1 part tin. The rod D is made of steel, tempered; the whole of them are flat, about one-sixteenth of an inch thick, and brought to a knife-edge. The expansion of the zinc rods is equal to .00269; that of the steel = .00137; which is as nearly as possible in a duplicate ratio, and they may be made exactly so by hammering the zinc rods.

Assuming, then, that the expansive properties of the rods are in the exact proportion of 2 to 1, it will follow that un-

der any variation of temperature the centre of oscillation of the pendulum will be unaltered, and a compensating-pendulum be thus obtained, at much less trouble and expense than that of the gridiron-pendulum, invented by Harrison.

I should recommend that the adjusting-screws, for bringing the pendulum to the true time of vibration, should terminate in nuts, which may rest in a mortice cut quite through any part of the bob, such screws forming the termination of the rods F and G. This, however, with other minutiæ as to the manner of finishing the joints of connexion, &c., may be safely left to the skill and ingenuity of any good workman, the principle alone requiring description.



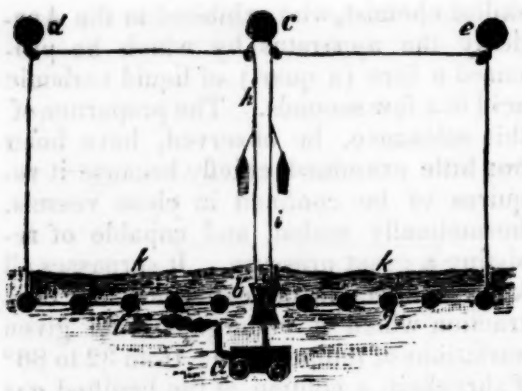
The above diagram shows how the effect will be produced by the unequal expansion of the rods, and needs no further description.

Mechanical Powers.—From a late foreign periodical we have gleaned the following interesting items, by which it will be seen that steam is not the only, and perhaps not the most economical power, that may be used for mechanical purposes. Much yet remains to be discovered in the arena of nature.

New Moving Power.—At a meeting of the French Academy of Sciences, on the 16th of June, a very interesting communication was read from M. Thilorier, a skilful chemist, who exhibited to the Academy the apparatus by which he procured a litre (a quart) of liquid carbonic acid in a few seconds. The properties of this substance, he observed, have been but little examined, chiefly because it requires to be confined in close vessels, hermetically sealed, and capable of resisting a great pressure. It surpasses all known bodies in the expansion and contraction which it undergoes from given variations of temperature; from 32 to 86° Fahrenheit, a column of the liquified gas is elongated one half. With the same change of temperature a similar column of air is only elongated one-eighth. This enormous dilation, M. Thilorier thinks, will, in future, afford the elements of a moving power infinitely more effective, as well as economical, than that which is derived from the expansion of vapor.

New Mechanical Power.—An ingenious mechanic at Brussels has just applied a new power to mechanics, from which great results appear to be expected. This new power is galvanism. Across a fly-wheel, which is to give motion to the machine, he has placed a metallic bar, previously magnetised by a galvanic pile, and within the attraction of two very powerful magnets. The moment that the bar arrives in a rotary course at the limit of the attractive power, and when it would necessarily stand still, the inventor, by the application of galvanism, suddenly converts the attractive into a repulsive power, which continues the motion in the same direction, and by these alterations, well managed, the whole acquires a rapid rotation. The experiment is said to have been completely successful, and the machine worked a whole hour.

Azote in Seeds.—Many seeds, as rice, yield, on distillation, says M. Gay Lussac, very acid products, whilst beans and most of the leguminous kind furnish ammonia. He concludes that, as a general rule, a grain, divested of its envelope, is formed of two parts, one of which is vegetable, giving an acid, and the other producing an ammoniacal product. All seeds, such for example as are gluey, or capable of being made into paste, contain a large proportion of azote. Wheat, therefore, is a curious illustration of this law.—[Scientific Tracts.]



[From the Journal of Commerce.]

CATCHING SHAD BY STEAM.—When Solomon said, many hundred years ago, "There is nothing new under the sun," he could not have foreseen that a portion of mankind so universally known as the "Yankees" would be continually inventing something "new under the sun," and bring the elements so completely in subjection to their will and pleasure as to change the order as well as the "eternal fitness of things." Man has been told that he should live by the "sweat of his brow;" but the "Yankees" by their ingenuity appear to be seeking out a way, if not to counteract this injunction, at least to make it as easy and pleasant as possible. They have earned a name by their enterprize, their daring, and their ingenuity, which, although some envious minded individuals may affect to cast odium upon it, has given them a character of which these same individuals are proud, and which is blended with that of the nation so strongly as to leaven the whole.

Among all the inventions that have ever been patented, the one I am about to mention not only caps the climax, but certainly is the last any one would have thought of projecting and putting in operation—IT IS CATCHING SHAD BY STEAM.

In the absence of a *drawing* and technical terms, I will endeavor to explain it as well as I am able, though I presume a more accurate description will be given when it is in operation, which will be very soon, in North Carolina—where catching shad is a very extensive business, employing for three or four months a great many negroes, &c. at considerable expense, as their nets are a mile in length. A steam engine (*a*) of small power is placed near the water's edge, with a concave wheel (*b*) attached to the shaft. Abreast of the engine, and at a suitable distance from the shore (*k*) for dropping the nets into the water, is a buoy (*c*) anchored, with two blocks fastened to it; at a distance to the right and left of the centre buoy are two more (*d* and *e*) with one block each. On the right and left of the engine are five more (*f* and *g*), making ten, with blocks also. From the concave wheel, two ropes (*h i*) run parallel with each other to the centre buoy, through the blocks, one passing to the buoy on the right, the other to the buoy on the left, from thence to the shore, and running through the blocks there, to the concave wheel connected with the engine. It will be seen that when the engine is put in motion, the ropes are in motion also. Two boats, having the net equally divided between them, are fastened to the ropes running parallel with each other, and are carried out by them to the centre buoy, then to the right and left, and of course, as they separate, the net runs off from the boats into the water until they reach the other buoys. All that is necessary for the men in the boats to do next, is to take the ropes attached to the net for hauling it in to the shore, which is done by having the rope as it runs ashore take the boat with it in the same manner as they were carried out. When this is done, the rope running through the blocks on shore is cast from them, (being made so that it can be done,) and the ropes for hauling in the net take its place, and being attached to the engine, the shad are rapidly wending their way to the shore. The time occupied in taking out the net to the buoys, when placed in the boats and hauling it again to the shore, must be much less than it has been by physical strength heretofore. The plan certainly appears feasible; and if so, a great revolution will take place in this business. So great, that some other "Yankee" must *invent* some new method of separating the bones from the meat, so that it can be consumed as rapidly as the market is supplied; for I understand that the patentee calculates that the net will make its voyage in twenty minutes from the time it is put in motion on board the boats. So confident are those interested, (the patentee lives in this city,) that it will be fully tested next spring. K. N.

Hartford, Ct., Jan. 17, 1835.

[From the London Mechanics' Magazine, for December, 1834.]

Axle-trees and Axle-friction.

SIR,—Since the period of the discussion, in your pages, on the subject of steam and other carriages, caused by my strictures on the Foreign Quarterly Review, my attention has been much directed to the subject of axles and axle friction, which, taken in all its varieties, is a matter of more importance to the community than almost any other question in mechanics. It is a question of the economical consumption of *power*, extending through almost every branch of mechanical art, and as a question of national economy, it is important that it should be thoroughly understood, not merely by theoretic writers, but by all mechanical workmen, and their employers.

There are many good workmen who have exceeding crude notions on the subject of friction. Some believe that it may be done away with altogether; others who do not go that length, think it highly important to diminish all bearing surfaces to the utmost practicable extent. These people are great advocates for making upright shafts rest on sharp conical points, instead of semi-circular balls working in cup sockets. Nay, I have heard one of them gravely argue, that for an horizontal axle, a three-square case-hardened bar, working in a hollow hardened cylinder, was better than all others. Why? because there was less surface friction! It was impossible to make him understand that the whole of the friction being thrown on a point, instead of a broad surface, could not in any way diminish its total amount, and that, as a practical matter, the abrasion of surface must be greatly increased.

If two metallic surfaces be brought in contact, and motion be kept up with sufficient force and velocity, heat will be elicited, and the metal will increase in bulk. The harder and the less porous the metal may be the greater will be the motion required to produce the effect, but abrasion of the surfaces will at last take place, and the metals will have a tendency to unite or weld together, as in the case of an axle and box "sticking fast." If oil be introduced between the two surfaces, the abrasion of the metal will not take place. The metallic surfaces are fixed bodies, the particles of the oil are rolling bodies. The movement becomes easier, and the diminution of resistance is called the diminution of friction. But the friction has not ceased to exist. It is merely that the greater portion of it is transferred from one body to another, from the surface of the metal to the surface of the globules of oil; what the metal saves the oil loses. The advantage consists in preserving an expensive material, such as an axle arm surface, and consuming a cheaper material, such as oil, which can easily be renewed. This fact furnishes a rule for the *size* of axle arms, independently of the strength of materials which may be required. The surface bearing must be so proportioned to the superincumbent weight, that the flow of oil between the lower side of the axle and its box may never be interrupted. If the arm be too small, the oil, which is a series of rolling bodies, will all be squeezed out by the superincumbent weight, the metallic surfaces will be brought in contact, and abrasion will ensue. If, on the contrary, the axle arm be too large, unnecessary friction will be caused, as well as superfluous weight. But, of course, the axles of steam engines and mills require much less proportional strength than those of wheel carriages and locomotive machines. Where momentum is added to weight, the surface bearing must be considerably increased, or the flow of oil between the axle and box will be checked, if not altogether stopped.

As it is clear that a free flow of oil is necessary between the surfaces, it is clear also that the flow of oil should as far as possible be rendered constant. In the case of a lathe mandril, the waste of oil is comparatively of little importance, consequently the best mode is to have a funnel-shaped column of oil pressing downwards on the working part, and freely passing off on either side the bearing. Oil, which is confined between two moving metallic surfaces, becomes thickened like tar. A lamp which is fed by a stream of oil constantly pumped through the wick, gives a more brilliant light than the ordinary kind of capillary lamps; the better portions of the oil are alone consumed, and a similar effect is produced by a stream of oil on an axle. In

wheel carriages and locomotive machines, whose wheels are fixtures on the axles, this contrivance can be resorted to, but, of course, the consumption of oil must in such cases be considerable. In wheel carriages whose wheels are moveable on their axis, there would be considerable difficulty in thus feeding the arms with oil; and in carriages which require neatness, the dirt and filth would be a great objection. Therefore, the desideratum is, to carry the greatest quantity of oil with the least possible waste, and without making the wheel centre unsightly in its exterior form. Oil, wherever it can be used, is the best of all lubricating substances for metal, because it is the most fluid, that is, the rolling particles pass each other with the greatest facility.

The earliest axles for wheel carriages were made of wood, and of a conical form, for two reasons: first, that it is easiest to fit a nave or box on a conical arm than on one of a cylindrical form; and secondly, in case of wear, the arm may be refitted by the wheel being worked farther up. The same form was continued, for the same reasons, when iron axles were introduced. Since that period, innumerable inventors have tried their heads and hands at the improvement of axles, and scarce a year passes that several patents are not taken out to die a premature death.

The commonest metal axle used at present is of a conical form, with a broad flat ring or washer driven firmly up to the shoulder, against which the wheel-box works. The wheel is secured against coming off by a front washer, behind a strong linch-pin. A thick unctuous grease is used for lubrication, to contain which deep channels are sunk in the box.

The next kind, instead of a washer and strong linch-pin, is provided with a screw-nut, formed to screw on the axle-end, in the direction in which the wheel turns, to keep the wheel on. Through both nut and axle a small linch-pin is driven. Some of these nuts are four-sided, others six and eight sided, and are consequently pierced with two, three, or four mortices for the linch-pin, in order to regulate the play of the wheel.

The next kind is the mail axle, so called from having been first used in the mail coaches. This axle is provided with a solid flat collar at the shoulder, against which the box of the wheel works. This axle has neither front nut, washer, or linch-pin. The arm is cylindrical, and is cut off flat at the front end; the front end of the box is closely stopped with a plate or screw, between which and the end of the arm there is left a hollow space for the purpose of containing oil, which is supplied by loosening a screw-pin in the front of the box. At the back of the box, near the shoulder, there is a second reservoir for oil. The wheel is retained on the arm of the axle by three or four long bolts, which pass through the nave from front to back, and thence through a circular plate of thick iron as large as the nave, which works against the back of the solid collar. Between the solid collar and the axle-box a thick leathern washer is placed to prevent any jar arising. The play of the wheel is adjusted by screwing up the nuts of the long bolts against the circular plate. The advantage of this axle is the security it affords against the wheel coming off, by three or four separate bolts. But it is otherwise very imperfect, as the oil wastes very rapidly when the wheel is in work, and the end of the axle not being secured in front, there is an irregular elastic motion, which causes the arm to wear unequally at the shoulder after a short time, and then the oil disappears still more rapidly. The mail axles are most commonly hardened, both arm and box, to guard against this; but it is of little avail. Mail axles are supposed to be lubricated with oil; but the fact is, that unless they be oiled every three or four days, they are actually lubricated with water. The process is thus: The front reservoir is level with the bottom of the axle arm, and consequently is level with the drainage or leakage point at the leathern washer. When the wheel is in motion it acts as a pump, and in a very short time drains off the oil of the front reservoir into the back, till it overflows; consequently the front is left dry. The bottom of the back reservoir is about an inch below the leakage point, and therefore it does not lose its oil by the same process as the front; but it loses it nevertheless. In the process of washing the wheel, and also in

rainy weather, water gets in between the washer and the box. Water being heavier than oil, sinks to the bottom of the reservoir, and the oil flows off. Thus it is, that almost every mail axle which is not oiled every few days, gets rusty and spoiled. While the oil lasts, of course, the friction is less than that of a common axle; and, as before remarked, the security is greater against the wheel coming off, but take it altogether, it is, though a neat looking, a very imperfect axle.

The next kind of axle, and the best which has been hitherto invented as applicable to ordinary wheels, is that known under the name of "Collinge's Patent." The original specification was, I believe, "a cylinder secured between two cones." But an axle on such a principle would not run smoothly; it would jar violently in the end play against the shoulder cone, and consequently the axles are never made so. The collar at the shoulder, against which the face of the wheel-box runs, is made very broad, flat, firm, and solid, and is, moreover, provided with an external rim or guard, which covers the end of the box, and excludes dirt and water. Close to the face of the box there is a reservoir of oil, and between the box and the collar there is a washer of solid leather. The centre of the arm is slightly turned down in the lathe, below the surface, to afford a lodgement for oil. The front of the arm beyond the box is turned down about a quarter of an inch, and a flat side filed on it. Upon this a small collar of gun-metal slides, the outer side of which projects in a conical form against the front end of the box, which is formed into a similar shape to receive it. Through this gun-metal collar a small hole is pierced to allow the passage of oil. It is thus evident, that when the wheel is in motion, owing to the flat side, the coned collar has no lateral motion, though it can slide along the arm, and regulate the play of the wheel. This collar is turned in the lathe when fixed on the arm, consequently it must fit accurately the end of the box, which is ground on to the arm. To adjust this collar to its place, and keep it firm there, two nuts of gun-metal, with right and left hand threads, one of smaller size than the other, are affixed. In adjusting, the first nut is screwed to the proper place, and then the second is screwed tight against it, one nut wedging the other. As a further security, a spring linch-pin is driven into the end of the arm beyond the nuts. Over the whole a large cap of gun-metal is screwed against the end of the box, with a washer of thin leather. This cap contains oil in its lower circumference, reaching to the horizontal level of the leakage point at the shoulder. The cap may be entirely filled, if it be wished, but it is useless, because the action of the wheel in turning would pump it away and waste it very rapidly. If it be wished to increase the quantity of the oil, the proper plan is to increase the circumference of the cap. The mode of feeding the axle is by the two reservoirs turning with the wheel, and the oil thus *washing up; and this is the only principle upon which locomotive axles can be fed with oil without wasting it.* Properly supplied with oil, a set of Collinge's axles, as they are at present made, will run about 5000 miles without sticking fast. The wheel is 5 feet 6 inches in diameter, which is about the height of the fore wheels of a full sized carriage weighing about a ton. The hind wheels would, of course, run farther with the same quantity of oil. As the arms of the axles are not horizontal, but dip downwards, the bearing is principally against the shoulder, and there is consequently little strain on the nuts; and the cap, also, in this position, holds more oil. But the friction must be increased. A horizontal arm runs with much less friction than a dipping one, because the dip serves to remove a part of the weight from the hardened arm against the softer washer. With the exception of those used in railway and steam vehicles, axles are all but universally dipped, or inclined downwards at the arms. There are sundry reasons for this. First, the extra security against the wheels coming off. Secondly, the greater facility of retaining the oil; and, thirdly, the facility it gives for using dished wheels. The advantages of the dished wheels are, that while keeping the same track on the ground, the length of the axle is not increased, and greater space is afforded for the body of the vehicle; and, at the same time, the dished form is stronger than the plane. When rightly adjusted,

the under spokes should be in a line exactly vertical to the base, and the upper ones form the angle. The strongest form of wheel is that in which the spokes are framed angle-wise to the nave, alternating both ways, to form a double cone, but this materially increases the length of the axle arm, and renders the nave unsightly

The disadvantages attending "Collinge's Patent Axle," are, considerable extra weight, owing to the thickness of the box, which is usually made of cast iron. The length of the arm is also increased by reason of the collar, double nuts, and cap; and, altogether, a nave larger than ordinary is required for its insertion. But the advantages are so great, that whoever uses a vehicle with common wheels, travelling at the rate of five miles or more per hour, must be ignorant of the science of profit and loss, if he does not use them. The mere labor of keeping other axles properly greased or oiled, and the risk of abrasion from neglect, together with the waste of oil and grease, and extra risk of coming off, will make a heavy balance against the comparative cheapness in the first cost of the common axles. The axles which I have examined bearing the name of "Charles Collinge, Lambeth," are for the most part as well made as the best engineers' work usually is; in short, they are as accurately finished as is necessary for any practical purpose. The only thing objectionable in them to the general purchaser, is their high price; but for a man who keeps a pleasure carriage, and is not a judge of workmanship, the wisest course is to pay that high price, and place it to the account of what Mr. Babbage has so well termed *verification*. Twenty-five guineas is the price, I believe, but they may be had of other makers for two-thirds of that price, some of them equally well made with those marked Charles Collinge, and some of them the merest rubbish. Without good workmanship, this axle is worse than a common one. The well-made ones are formed of thin bar-iron, welded by hand into a mass (fagotted), and case-hardened, both arms and boxes. After hardening, the boxes are ground on to the arms with oil and emery, consequently they cannot be perfectly true cylinders, though intended to be so. Birmingham made axles have of late, on account of their cheapness, come much in use; but unless coming from a known maker, they are not to be trusted, as, to save expense, they are commonly made from square rolled bars, good or bad, subject to flaws, sand-cracks, and cold shorts. For self-axles, *i. e.* axles which are bolted to two springs at the ends, and have no other bearing, as is the case with the street cabs and gigs generally, a good method would be to make the centre or bed of the axle of drawn or rolled tube; weight might be thus saved without loss of strength, and tolerable security would be taken for the goodness of the metal.

The axle patented by Mr. Birch, and described in No. 589,* I consider to be a very imperfect one. The mode of fastening the wheel on by means of a single nut and linch-pin, is not comparable to the double nut and collar of "Collinge's Patent." Collinge's nuts, when screwed tight, become nearly as solid on the arm as though they were welded there. They are, in fact, two circular wedges, forcibly levered one against the other, without jamming the box. Mr. Birch's nut, on the contrary, cannot be made firmer without jamming the wheel fast. All screws are, in fact, circular wedges. No wedge acts firmly unless it bears on two sides. Mr. Birch's nut only bears on one side, and is kept from sliding or turning by the linch-pin; consequently it must rattle when the wheel is in motion over a rough road. The plan of coning the front of the nut against the box is not a good one, because the accuracy of the fitting depends on the accuracy of the male and female screws. To cut these threads so true as to ensure the cone working true in turning round, would require time, tools, and workmen, far too expensive for an axle-tree maker's use. The front cap is precisely the same as Collinge's; the remaining difference is the introduction of the two cylindric barrels, or false boxes, between the arm and the true box.

One solitary advantage alone can attend this. If any grit or particles of silex, harder than the hardened metal, chances to get between the arm and box,

* See page 1, current volume, of this Magazine.

it cuts the surfaces, and acts as a key, causing the box to "stick fast." If Mr. Birch's arm were in this predicament, the wheel would not stick fast, because the two false boxes would revolve within the true one, unless the silex extend to their surfaces also. Against this advantage are to be set the disadvantages of a very considerable increase in the weight and size of the outer box, as well as the nave of the wheel. The inner boxes or barrels cannot be less than one fourth of an inch in thickness, making a total of one half. The difference between the outer box of Birch and that of Collinge must be as the area of a circle of three inches is to three inches and a half, or, probably nearer the truth, three inches and three fourths. Then follows the expense of manufacture. It must be exceedingly nice work to adjust the barrels, which are ground to an accurate fit, inside and out; and if not, the jarring must be intolerable. It has not been stated what the materials are.

All that is offered in testimony of the excellence of Mr. Birch's axle is mere verbiage.

"One wheel of Mr. Birch's gig being once oiled was never again disturbed until worn out."

All very possible; but will Mr. Birch be good enough to inform us, how long it took to wear it out; or, in other words, how many miles the gig run, and at what rate?

"The other wheel had the cap taken from it, and ran 600 miles."

Very possibly, also; but what does it prove? It might be done with one of Collinge's as easily as Birch's, for aught that there is in the construction. Nothing is said of the rate of travelling.

"The arm was cleaned and polished, and put together without any oil; when in this state the wheel ran sixty miles without sticking fast."

Mr. Birch does not say how long it took to run the sixty miles, nor any thing of the condition of the axle at the end of the journey. Travel slow enough, and any common axle will run sixty miles without stopping, and without oil if sufficiently large, and not loaded, and the radius of the wheel be not too small.

"Sir John Conroy found the axles answer exceedingly well in the carriages of her Royal Highness the Duchess of Kent."

Who is Sir John Conroy, that faith should be given to his quoted opinion? Has he acquired any name of repute as a man of science or a mechanic? The coachman himself would have been as good authority, after drinking a bottle of *Birch* wine. Court success depends on many more considerations than mere excellence and desert.

"John Ramsbottom, Esq., M. P., had a cabriolet with one of these axles, which was oiled on the 9th of November, 1831, and not touched till the 23d of May, 1833, when it was found quite full of oil."

What, Mr. Birch, quite full, quite? No loss by friction—none whatever? Pray, how many miles had it run? Verily, Mr. Ramsbottom must be either a man of sound faith or careless habits, if he used his cabriolet much. But more yet.

"It was again fitted with the same oil, and the cabriolet continued in use until 12th May, 1834, when the axletree and wheel were examined in the presence of Dr. Birkbeck and Mr. Charles Toplis."

Dr. Birkbeck, it seems, did nothing, unless, perhaps, to exclaim, "prodigious!" Mr. Toplis gives a certificate that the axle was in good condition; but, I confess, I see nothing more satisfactory in the certificate, than in one of Dr. Morison's regarding his pills. A certificate, to be worth any thing, must be one given after due examination, and careful guarding against the possibility of mistake. Had the cabriolet been laid up in ordinary the whole or any part of the "above two years and a half?" An axle might be filled with oil and left quiet, and thus retain for two centuries as easily as two years. If Mr. Birch wishes really to test his axle, he should apply it to a stage coach, known to run certain distances every day; oil it, and put a Chubb detector-lock on it, the key to be left with a known public man of mechanical skill. Such a trial might be taken for something, for the number of revolutions of the box around the arm might be calculated from the size of the wheel. In the work done by an axle, the weight it bears, its size, the quantity and quality of oil it uses, the distance it runs, and the

size of the wheel, must all be taken into the account.

One word more. Mr. Birch is styled "the eminent coachmaker." Now, if these words mean any thing more than a tasty painter, or an ingenious upholsterer—if they mean a scientific constructor of a wheel-carriage, will he be good enough to state the size of the wheels on Mr. Ramsbottom's cabriolet, and the thickness and breadth of the tire, as well as the quality of the iron? He can then inform us how far such wheels can run on an ordinary Macadamised road before wearing the tire off. This distance we can divide by the number of days which elapsed betwen the oilings, and thus ascertain the amount of Mr. Ramsbottom's travelling. Mr. Toplis does not state whether the wheels were in as good a condition as the boxes, or whether Mr. Birch puts new wheels on his boxes, or new tires on his wheels, without taking either off the axle-arm?

Seriously—Mr. Toplis, as director of a Public Museum, giving a certificate of public importance, is bound to satisfy the public as to the reason of these apparent discrepancies. There is far too much attempted to be proved in favor of mere earthly materials. Such powers are not to be found in simple oil and metal. As a Yankee would say, "I guess a ruby axle runnin' in a diamond gudgeon, and oiled with anti-friction gas, couldn't do more. It beats the north pole, with the aurora borealis for a pivot hole, all to smash. The leetle eend o' nothin' whittled down, and runnin' in a moonbeam, aint to be compared to it."

Let me be understood with regard to what I have said on the subject of Collinge's patent axles: though I consider them the best which have yet appeared, I think that the greatest possible excellence is still to be obtained.

I remain, sir, yours, &c.

JUNIUS REDIVIVUS.

November 27, 1834.

[From the Journal of the Franklin Institute.]

Description of certain Improvements in the Process of Tanning. Patented by EDWARD S. and DANIEL BELL, Smithfield, Jefferson county, Virginia, July 28th, 1834.

The objects of the improved modes of procedure for which this patent is obtained, are, First, The softening the hides, or skins, and the freeing them from grease. Secondly, Expanding the hides preparatory to their receiving the tan. Thirdly, The procuring the *tannin*, or tanning principle, from the ooze, pure, by filtering. Fourthly, Causing the tanning lixivium more readily to enter the hides, by the use of mechanical compression made upon them, under the surface of the ooze, and thereby shortening the operation.

The claims made are to the modes, and apparatus, adopted for the attainment of these ends. For softening the hides, twenty-one and a half pounds of caustic lime, unslaked, and levigated, and sixteen pounds of carbonate of potash, and one pound of carbonate of soda, are to be added to every two hundred cubic feet of water. In the alkaline liquor thus formed, the hides are to be suspended in the usual way, by which means they will be completely softened, and have their grease neutralized, in from twenty-four to thirty-six hours.

The expanding or raising of the hides is to be effected by adding to every hundred feet of pure gallic lixivium, one pound of tartaric and one pound of sulphuric acids; by suspending the hides in this solution, a complete expansion, it is said, will take place in six or eight hours.

To procure the tanning liquid pure, the ooze, after having been obtained from the bark, is to be filtered by putting it into a vessel of the nature of the common hopper for obtaining ley, the bottom and sides of which are to be covered with about eight inches of raw cotton, and filled in with fine refuse tan, or exhausted bark. Through this the pure tanning liquor is to be passed, and collected in a proper receptacle.

The most important part of the process, however, appears to be the following, namely, the subjecting the hides or skins to mechanical pressure under the surface of the ooze, or tanning liquor. The apparatus employed for the purpose is fully described, and well represented in the drawing. A platform is to be made, and placed upon firm supports, which platform may be suspended between two vats containing ooze, and in which the hides are suspended The platform stands a few

inches below the level of the ooze in the vats, which is admitted to flow over it, there being ledges which serve to retain it upon the platform. Upon this platform the hides are to be submitted to the requisite degree of pressure. The tanning liquid is to be kept, by means of heaters, at a temperature of 98° Fahrenheit. The hides are to be taken from the vats, and spread smoothly upon the platform, and then a kind of carriage, sustained upon two long rollers of wood, or brass, is made to pass over them, the carriage being loaded with such a weight as may be necessary for the skins to be operated upon. The guides, ways, friction rollers, pulleys, &c., which are employed in the moving of this carriage back and forth, we need not describe. The object of this pressure is to remove the watery particles from the pores, which are left there after the ooze has become exhausted by the combination of its tannin with the skin; the pores are thus closed, and the skin condensed, and in that state it is to be slipped again into the vat, without exposing it to the air, where, in the course of six or eight hours, it will again be expanded by the refilling of the pores with fresh ooze. This operation is to be repeated, employing a stronger tanning liquid after the first has produced all the effect expected from it; and thus, in succession, a stronger and stronger, until the process is completed, "which, for heavy leather, takes place in six or eight weeks, and for light skins, in from six to twelve days." To economize time and labor, there must be a series of such vats and platforms as have been described, thus enabling the workman to proceed readily from a weaker to a stronger solution, these varying according to the nature of the skins; and requiring to be regulated by the judgment of the workman.

Specification of a Patent granted to HENRY CRANE, *Merchant, and* JOHN YOUNG, *Patent Lock Manufacturer, for their invention of certain improvements in the making, manufacturing, or forming, of Iron Hoops for Casks, and other purposes.*—Sealed 20th March, 1834.

These improvements in making, manufacturing, or forming, of iron for hoops for casks, and other purposes, consist in giving to the narrow strips of hoop iron a curved figure; that is, bending the strips of iron from the usual straight form in which they are delivered by the ordinary operation of rolling, into such a curve suited to the diameter of the barrel round which the hoops are intended to bind, as will enable them, when formed, to lay close to the conical or elliptical surface of the barrel. This is effected by a peculiar method of acting upon the strips of iron by means of rollers, in order that such required lengths of iron, when cut off and bent round into the circular hoop shape, may be formed slightly tapering, or as the frustrums of cones.

The method by which this is effected, is by drawing out the bar or rod of iron by rolling, in the first instance, in a heated state, in the usual way, until it has been reduced to nearly the required thickness; we then set the rollers, so that their axles incline at a slight angle from the true parallelism, by which means the peripheries of the rollers will be nearer together at one end than at the other, and the strips of iron being then passed between these inclined rollers, will be necessarily compressed, or formed on one edge thicker than at the other edge —that is, of a wedge shape, if cut in a transverse section. This may be done by relieving the screws which confine the axle at one end, and tightening them at the other end; or the same might be effected by making the grooves and ribs of the two rollers inclined to each other, instead of parallel.

When the strip of iron has assumed this wedge shape, in its transverse sectional figures, we then pass it, in its heated state, between a pair of parallel rollers, which, by pressing principally the thicker part of the substance of the strip of iron, causes that thick part to expand and elongate more than the thinner part of the strip, and, consequently, to extend or elongate the strip more on one edge than on the other.

This mode of operation will cause the strip of iron, as it is discharged from the parallel rollers in the last instance, to assume the form of a regular curve, and which curve may be varied to suit any required diameter and inclination of the surface of the cask, or barrel, by varying the inclination of the rollers, or the bevel of the groove, by which the strips are

compressed into the wedge shape, that is, thicker on one edge than on the other; and in order to prevent the strip of iron from bending into irregular curves, as it passes in its heated state from the rollers, we have found it useful to place a curved guide, or conductor, near the rollers, which will enable the workman, as he draws out the strip of iron from the rollers, to preserve its desired figure with great accuracy.

Lastly, we wish it to be observed, that as the rolling of iron, for the purpose of bringing it into thin and narrow strips for the manufacture of hoops, is not new, of course that process is not to be considered as claimed by us; but the taking of strips of iron, previously made thicker on one edge than on the other, and passing them between parallel rollers, for the purpose of expanding the metal on one side of the strip more than on the other side, and thereby giving to the strip a curved figure as it is discharged from the rollers, being, to the best of our knowledge and belief, new, and never before employed by any other person, or persons, in the manufacturing of hoops, we claim that mode of operation as our invention, and forming the essential feature of our present patent right.—[Lond. Journ.]

Hooks and Eyes.—A young man in Boston, who recently returned from a whaling voyage, has constructed an uncommonly ingenious machine, in School street, for manufacturing hooks and eyes. It possesses advantages over any heretofore constructed, from this circumstance, that by altering a few screws, hooks or eyes may be made of different sizes. Those ordinarily in use can make but one size. After viewing this beautiful contrivance, which seems to possess consciousness, from the manner of its handling a skein of brass wire, we were at a loss which to admire most, the complicated apparatus effecting such surprizing labor, or the man who must have contrived the whole, and witnessed its unerring operations in an ideal form, before a single portion of it ever assumed a tangible shape.—[Scientific Tracts.]

Coal in Massachusetts.—Prof. Hitchcock, in his elaborate geological survey, represents a bed of coal as existing near the east line of Cumberland, and another in the north part of Middleborough, and a third in Bridgwater, and a fourth in Wrentham. However, he could not be satisfied that much of that important article had been obtained in either place. Time, without doubt, will develope rich beds of anthracite in those places.

[From the London Mechanics' Magazine.]

EXPLOSIVE FORCE OF DETONATING POWDER.

Sir,—A few evenings back I tried, with a friend, the explosive power of percussion caps, with a fowling-piece, and was extremely surprised at the result. The flame of a large candle was put out at nine feet distance from the mouth of the gun, and was much disturbed at 14 or 15 feet distance. I do not suppose the copper caps contain more than one-quarter of a grain each of the detonating powder; which small quantity generates, it appears, sufficient gas to displace the air not only contained in the gun-barrel, but also an horizontal column of the diameter of the barrel nine feet in length. Upon my placing my hand immediately behind the candle, the effect of the explosion felt similar to a puff of wind from the mouth upon a small pot. Although I did not then try the quantity of gunpowder required to produce the same effect, I have no doubt but the detonating powder thus used is upwards of 200 times stronger than gunpowder, which is as one-quarter of a grain to one drachm Troy; and independently of this great superiority in generating gas, it appears to be much more rapidly susceptible of perfect explosion.

I am induced from these circumstances, to think a great advantage would be gained, for many purposes, by mixing the detonating powder, which is, I suppose, a precipitated nitrate of silver, with gunpowder, particularly in charging shells, and even for general purposes in different proportions; as, besides the additional strength, the internal surface of guns would, no doubt, become foul in a much less degree. A much cheaper preparation, and nearly as powerful, can be made with quicksilver. The chlorate of potash and antimony form a powerful, but in some proportions a highly dangerous, percussion powder.

Your obedient servant, J. L. S.

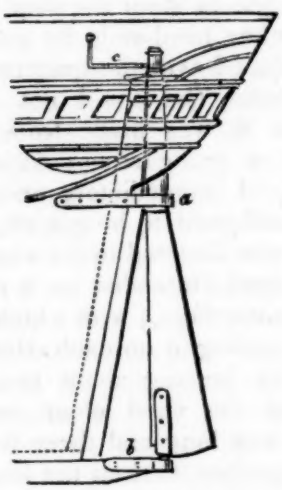
Enfield, Dec. 8, 1834.

[From Partington's British Cyclopædia.]

RUDDER, *in Naval Architecture:* a movable frame of timber, attached to the stern of a ship or boat, by which it is steered. This is usually effected by a wheel placed towards the stern of the vessel, and the rigging being placed between the helmsman and the course he is to pursue tends to prevent his accurately directing the vessel. To obviate this inconvenience it has been proposed to place the steering-wheel in the bow and make a communication between the rudder and wheel by long ropes. This arrangement is evidently superior to the one generally adopted, and has been found practically useful on board some of the steamboats.

The common rudder is supported by pintles, which only admit of a given amount of rotation, but Mr. Holdsworth has invented one which will revolve completely round the axis which supports it. By this contrivance greater facility will be obtained in steering, while such rudders so applied will be less liable to be carried away when struck by a sea, or from the ship suddenly making sternway, in consequence of the rudders so applied to the ships or vessels being enabled to make a whole revolution on their axes.

The rudder, with its connecting supports, is represented in the accompanying figure.



It is to be observed that the invention applies only to those descriptions of ships which have a single stern and stern-post, but does not apply to double or twin-bodied boats, which have rudders placed between them.

The axis of the rudder must be carried out from the lower part of the stern-post, and stand perpendicularly as shown in the figure. It is to be supported at top by a strap and collar, which strap is made fast to the transom, or to the stern frame, as near the top as conveniently may be, and through the collar the upper part of the rudder passes, and turns in it at *a*.

The lower end of the rudder is supported on an elongated part or continuation of the keel, at *b*, where a metal gudgeon is fixed to receive it, the object of so mounting the rudder at a distance from the stern-post is to enable it to turn completely round, without coming in contact with the stern post.

It will be seen that this rudder is without the usual pintles, and the front or bearded part is cut to a ridge shape; it will also be seen that in order to apply the improvements, the stern-post of the vessel must be made to stand at such an angle to the axis of the rudder as will afford space sufficient for the rudder to make a complete revolution on its axis.

This rudder may be actuated by a tiller, *c*, and tiller ropes, in which case there should be a strong pin in the end of the tiller farthest from the rudder, or the end of the tiller may be turned up, as shown in the engraving. Upon this turned-up part of the tiller a swivel should be placed, having two eyes, to which the tiller ropes are attached, or the rudder may be actuated by means of a pinion affixed on an upright shaft working into a horizontal toothed wheel affixed on the head of the rudder, such upright shaft having a horizontal steering wheel in the usual way, or it may be worked by any other of the usual combinations of mechanism employed for steering, care being taken that whatever mode be adopted, whether by tiller or otherwise, a whole revolution can be made by it.

In steering a vessel which has these improvements in the construction and fixing of the rudder applied, it will be necessary, in the event of its being desired that the ship should make sternway, for the man at the helm immediately to let go the wheel or steering apparatus, and on the ship moving by the stern, the rudder would revolve upon its axis, and turn into the space left between the stern-post and the axis, and be in a line with the keel, when the helmsman will again take

hold of the tiller or wheel, and will be enabled to cause the rudder to take any angle with the keel consistent with the new course of the ship.

Messrs. Peeke and Hammick have a patent for improvements in the mode of hanging rudders, but they are not of sufficient importance to warrant our describing them in detail.

The power of governing a vessel, and as such, its utility for nautical purposes, entirely depend upon the action of the rudder; but several attempts have been made to direct large vessels without this important appendage. One of the most valuable substitutes for the rudder was contrived by Capt. Peat; and the Journal of his voyage, with the progressive improvements in his temporary rudder, forms one of the most interesting histories of human perseverance and mechanical ingenuity on record. Our space will not permit of the entire Journal of the transaction, but the following connected abstract from the log-book is so important as to warrant its insertion.

"At three-quarters past two, A. M., a heavy sea struck the ship under the counter, which carried away the tiller, breaking short in the rudder-head. We got relieving tackles on, and choked the rudder up as well as we could, (for there were no proper chocks fitted,) and the carpenter was under the necessity of chiselling the broken part of the tiller out of the rudder head. At day-light we observed the two uppermost of the rudder-braces under the counter were nearly off the stern-post. At 7 A. M. the rudder broke adrift from the stern-post below, hanging only by the upper pintle on the rudder-head. The ship steered on the upper deck. The great sea that was running occasioned the ship to labor and pitch very heavy; the rudder in consequence having so much play, began to shake the stern-post, and tear away the counter. We got a purchase on the rudder, with an intention of heaving it up to clear the upper pintle which it hung by, and then to cut it adrift; but at that moment the rudder received another shock by a heavy sea, which broke it short off under the counter: the lower part dropping astern, we hove the upper part up and cut it away, going altogether clear of the stern frame.

"On the 4th of January, the gale still continuing, with a great sea running, and the ship laboring in the trough of the sea very much, we set the mizzen top-sail close reefed on the cap to keep the ship closer to the wind, having no storm mizzen. Towards night the gale increased at S. E., the ship's head to the southward and westward. In this dreadful situation we were left, without any ship in company, and 263 souls on board; it then became absolutely necessary to have recourse to some expedient for governing the vessel. Having examined carefully a book of naval tactics I had in my possession, I found a plate of Pakenham's temporary rudder with the description accompanied, which gave me some little hope of success; but on further investigation, it appeared to me quite impracticable to ship a rudder on that plan if we had succeeded in fitting it, owing to the heavy sea that was running, besides which I had no spare cap on board, and as we steered on the upper deck, the sea must have been perfectly smooth to succeed in getting the rudder-head up the case, without materially injuring the counter.

"It was at this time one of the seamen represented to me that he had been on board a Turkish frigate in a similar situation in the Mediterranean sea, and they managed to steer the ship tolerably well under her head-sails by means of a machine placed over the quarter or stern of the vessel, (he could not recollect which,) but it was made from a spare spar, with a gun-carriage fixed to the end of it. I immediately ordered the spare top-sail-yard to be got aft, and the carpenter was directed to get some three-inch oak plank, (intended as a substitute for the gun-carriage,) with which to form a case by nailing it on each side of the top-sail-yard, leaving about two feet of the end of the yard clear, making it about four feet long and three feet deep, secured together, first on the inside with inch plank nailed the contrary way, having a piece of three inch oak, about one foot in depth, placed on the inside of the lower end of the case, to which the planks were well nailed, and the bottom part of the case leaded over, having about 28 lbs. weight to keep this part of the machine down in the water. Two guys

were fitted round the top-sail-yard, about two feet above the case of the machine, to be brought on the quarter-deck from each quarter, to keep the machine steady, the seaman referred to having represented they had steered in the Turkish frigate with tackles on the inner end of the spar.

"On the 5th of January we had fresh gales, with a heavy sea. We finished our temporary rudder, and got it over the stern, which we did with greater facility by means of a tackle on the end of the spanker boom. This tackle became of the greatest service to us afterwards in getting the machine in and out, and in the event of tacking or being taken aback to prevent the machine from going under the ship's counter. We found it impossible to steer by the tackles on the inner end of the machine, which came on the quarter-deck over the stern. Although there was at this time a very heavy sea, I ordered the machine to be hoisted up and launched on the quarter-deck, to make some alterations which then became absolutely necessary. The gale was abated a little, but the ship rolled very much. We set the top-sails close reefed to steady her.

"We were proceeding with our improvements on the temporary rudder, and I found it necessary to steer by this machine from the outer end, and to have out-riggers on each quarter, with blocks at the ends to receive the guys or pendants through, which were fastened round the spar two feet above the case. For the out-riggers, I ordered the spare topmast to be laid across the after part of the quarter-deck, and lashed on each side to the timber heads, the ends of which projected about twelve feet outside of the quarter where the top-blocks were lashed for the rudder guys to reeve through. The ends of the guys were made fast to luff tackles hooked on to a strap round the mizzen-mast, and the inner end of the machine was steadied by lashings to the midship ring bolts of the stern stanchions. On the above plan, we had great hopes that we should succeed in getting the ship's head round on the other tack, and all hands were employed in making the necessary alterations. The weather was more moderate, and some of the soldiers came on deck for air. The ship still continued to make a great deal of water, which, it is supposed, arose from the nail-holes of the rudder braces, and the stern-post being strained.

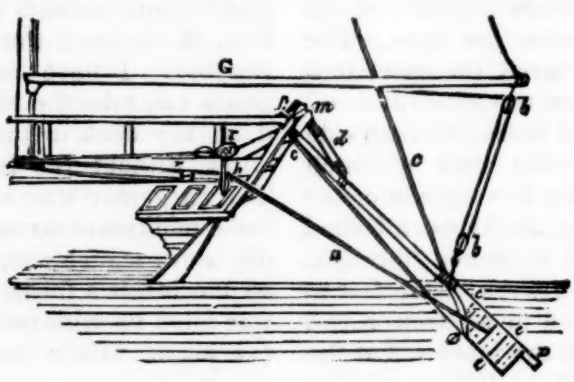
"The rudder was finished at 9 P M., and we got every thing in readiness to launch it on the following morning; but at day-light we made some further improvements on the plan, and tried to wear ship with the stern cable and assistance of the head-sails, but without effect. On the 7th of January, P. M., although there was a very heavy swell of sea running, we got the rudder over the stern, set all the head-sails, and wore ship, to the inexpressible joy of every soul on board. We let the first reef out of the fore-topsail, and set the jib to assist the steerage, having at this time eighteen men employed at the luff tackles to steer; and, indeed, she did exceedingly well under the head-sails and close reefed main-topsail, going the whole twenty-four hours seven knots and a half per hour. The wind abating, and the sea going down, we made more sail, the hatches were opened, and the dead-lights taken out. This day provisions were cooked and served out to the troops for the first time since the accident.

"Owing to the necessity of having from fifteen to twenty-five men constantly at the luff tackles to steer, I this day formed a plan for taking the purchase used for steering to the wheel; at the same time having in contemplation several other improvements on the rudder. At 9 A. M. hoisted the rudder in for that purpose. I have to remark, that ten hands can take the rudder in and launch it on the deck in the space of three minutes, without the least risk of injury. The carpenter was employed in making some additional securities to the two middle stern stanchions, by adding to them on the inside a frame made of oak, which was filled up with two pieces of four inch oak plank, with a hole made in the centre, which was to receive the inner end of the machine, about one foot in. The whole of this frame was shored up from the deck, first nailed and bolted to the stanchions, one of which was broken, and was the cause of making this false frame. The machine had a sort of shoulder formed at eighteen inches distant from the inner end. This shoulder was made

by cutting up two capstern bars, and making cleats about eighteen inches long, nailed and well moulded round the top-sail-yard as before stated, about eighteen inches distant from the inner end, which would act in the socket, when leathered and well greased, with perfect ease, chamfering or cutting away the outer part of the socket, so as to give the machine sufficient room to work from side to side in tacking or wearing, (in which case it required to make an angle of only twelve degrees instead of forty-five, which the regular rudder is supposed to do,) or up and down by the ship pitching in a heavy sea; and for the greater security of keeping the inner end of the machine firm in the socket, we had two gun tackles fixed on each side of the machine, about eight feet down from the socket, fastened round the taff-rail and false frame. The guys or pendants which were fitted on the machine, two feet above the case, were now fitted round the spar in the centre of the case, by cutting two holes through for that purpose. On the 12th of January, at 8 P. M., the machine being completed, we got it over the stern, and found to our satisfaction the machine acted with great effect. At 10 P. M. brought the tackle falls to the wheel, and found it answer very well, steering with two men at the wheel, the same as with the original rudder.

"On the 15th of January we got the rudder in, and added a piece of wood to the fore part of the case, and covered it over with two-inch plank, well nailed; one end of the piece being fitted into the case. This lengthened the case, at the top part, adjoining the spar two feet, reducing it entirely at the lower part of the case, which was chamfered off sharp, and leaded, as it required more weight, which made a sort of cut-water or stern to the machine, which being brought close to the spar prevented it catching any wreck, or any thing else we might fall in with at sea, or in rivers or roadsteads; when working ship, it would prevent any ropes or cables catching it. At 4 P. M. we got the rudder again over the stern, and found it greatly improved. From this time until we made the east end of Jamaica, at noon, on the 22d, the machine acted with equal effect on the ship as with the proper rudder, and carrying the same sail, having frequently very strong breezes, and a heavy swell, the ship for many hours together going nine and ten knots, making the passage from Barbadoes to Jamaica in a little less than seven days. Thus ended a voyage in the ship Cornwall, having only sailed four days from England when she lost her rudder, and afterwards run a distance of at least 1250 leagues, being at sea forty-one days."

We may now proceed to a graphic illustration of the apparatus employed by Captain Peat, for which he was rewarded by the Society of Arts.



In the above figure the whole apparatus is exhibited in operation.

To fit out a ship on this plan, the following materials must be collected and prepared as soon as the rudder is gone.

1st. A spare top-mast and two top blocks, which must be securely lashed on at each end of it

2d. A top-sail-yard, C D, which must have cleats, nailed securely upon it, forming a shoulder at the end, C, which is to be kept on board; and at the opposite end must be framed a case, *e e e*, formed of pieces of oak plank nailed firm to the yard, on each side, the left or foremost part being chamfered off and leaded, so that

by presenting a narrow edge, it may make the less resistance in passing through the water.

As the taff-rail will not in general be found sufficiently strong to resist the force of the machine, a frame must be composed of substantial pieces of oak, and erected behind it upon the deck; it consists of two uprights, set up from a sill, which is spiked down upon the deck, and they support a rail, *p*, which is firmly lashed to the taff-rail, and the whole is strengthened by three shores carried from the deck to the uprights. Between these is supported a piece of oak, four inches and a half thick, with a hole through it, of a proper size to receive the end of the yard; the hole is leathered inside, in which the end of the yard acts with perfect ease, and can move about in all directions; the tapered end of the yard is leathered also, that the whole may act easily. While these parts are preparing by one part of the crew, some should get the top-mast over her quarter, and make it fast by proper lashings; the others should be ready with the several tackles which rig it out, to give motion to the rudder when in the water. They are as follows: Two principal guys, *a*, made of rope, which is five inches and a half girt, and should be of very good materials; they are to be made fast to the boards at *e e*, and carried through the top blocks at *h i*; the end has the block *r* attached to increase the power, the other block being lashed to one of the stanchions on the ship's quarter, and the fall carried through the leading blocks to the steering wheel, situated upon the ship's deck.

A second set of blocks, *b b*, suspends the weight of the rudder from the boom, G; it is a gun-tackle purchase, and is of great use in getting the machine out of the water, and also to assist in getting it in; the fall of the purchase is carried along the boom to a cleat spiked to it. *c* is another topping-lift from the rudder to the mizzen-mast head; it likewise assists to get in the machine, as well as for a substitute, should either of the guys break; it should be three inches and a half rope. Two short tackles, *d*, are fixed to the taff-rail and cross-piece, *p*; they are for the purpose of holding the end of the mast firm in the socket, and materially aid in placing and displacing it.

There is also a rope stretched tight from the planks, at *e e*, and on this a weight is suspended. The machine is ballasted sufficiently for common occasions, when the ship is going less than eight knots; but this additional weight, consisting of shot sewed up in canvass, is to assist in keeping the whole of the machine in the water when going more than eight knots; and, when going less, to be hauled up by a line.

The mode of operation in this machine will appear evident from the above description; the steering wheel, being turned either way, acts to bring in the fall of one of the guys, *a*, and give out the other, producing an inclination of the rudder, so as to put the ship about as expeditiously as a common rudder, and upon the same principle, namely, that of producing a resistance to the ship's motion on either side of her keel at pleasure. The ship Cornwall, in which the contrivance was first tried, had her wheel fitted close to the rudder-head, and she steered with a short tiller abaft the rudder.

Silk Manufacture.

At the present season, when silk is beginning to be produced in almost every section of our country, it must inevitably be but a short time before it will be a matter of importance to find and secure a permanent market. It must be obvious to any person of reflection, that the surest market will ultimately be to sell it to the manufacturers in our own country. But as it can scarcely yet be said that any such manufactory exists in this country: and as considerable time must elapse before any such establishment can succeed in the more complicate and extensive branches of silk manufacture, it is certainly a matter of high national importance that we commence with such branches as are more simple, and on a smaller scale, therefore hazarding less capital, and the skill more easily acquired.

Under these impressions, I would hereby inform the producers of silk, and any one who wishes to adventure in manufacturing it, that there is now in this county a mechanic, whose purity of character and correctness of habits are not perhaps surpassed by any one, who has been nearly 15 years employed in Europe as

the head mechanic in a ribbon factory, in which were from 30 to 80 looms operated by steam, weaving from 16 to 20 pieces in each loom, and each piece averaging about 20 yards of ribbon per day. This man is perfectly and practically acquainted both with making and using every part of the necessary machinery, and is a complete master of every part of the business. He is in no regular business equal to his talents, and is very desirous to find some person who would invest a small capital, which he is confident he could gradually increase; and his habits and character would convince any person acquainted with him of the correctness of his confidence. Could he meet with encouragement, he would obtain persons of his acquaintance, for whose characters and abilities he can vouch, capable of superintending and teaching each branch, and of producing every species of ribbon, from plain to the most fanciful and complicated figures, all woven by artificial power.

There can scarcely be a doubt but that such an establishment would be profitable, and would not only save vast sums of money to the country, but would be a respectable beginning, which could safely and perhaps rapidly extend itself to branches of more consequence.

LANSINGBURGH.

PRIMARY GEOLOGY.—Dr. Boase is the author of a work expressly devoted to an examination of the *older formations*, or primary geology. From the few extracts and notices made of it abroad, it is certain of being received favorably by geologists in this country. The world was very slow in its progress towards its present condition; every object on which the philosopher fixes his eye, proves to him by incontrovertible evidence, that all this beautiful apparatus of vegetable and animal organization was a long time in being developed. The globe was in no condition for the present races of animals much longer ago, if any, than six thousand years. Traces of those constructed for existing on the earth in its primitive state are found imbedded in the rocks, to show us what has been. Certainly the forms of animals diminish in complexity of structure and in numbers as we go back in the series, till they are actually lost in the granites.

BOSTON LYCEUM.—The lectures before the Lyceum are given at Boylston Hall. One discourse, given a-while since, by the Rev. Mr. Wells, on what was denominated a Reform in Education, was well worth the cost of a ticket, had no other lecturer appeared during the term. To a thorough acquaintance with all the modern processes of education, he brought before his hearers the results of his own experience in teaching, which was exceedingly well received. There was a fine vein of wit running through the lecture, that not only amused but instructed the audience. By the delicate and well-timed thrusts which he made from time to time, at the monstrous absurdities practised in some of the elementary schools, with a view to making precocious scholars, or what are called improvements, were clearly shown to be innovations. On the whole, it was a praiseworthy performance, and would show to a good purpose in a pamphlet.—[Scientific Tracts.]

CHINESE GONGS.—We have been furnished by a friend with several numbers of the *Asiatic Journal*, in which we find the following description of the composition and manufacture of the "Chinese Gong," an article now much in use in hotels. They are, especially to those unaccustomed to early rising, instruments of "horrible music;" yet, to many, an article of considerable interest, as it has often been said, and by many believed, that they cannot be made in this country.

Composition of Chinese Gongs.—In the Annals de Chimie for November, there is the following account of the Chinese process of manufacturing gongs and cymbals, translated by M. St. Julien from the Teen-kong-kae-weh, a Chinese encyclopædia of arts and manufactures:

"The red copper, used in making musical instruments, must be alloyed with mountain-tin,* which does not contain a particle (*lit.* a vapor) of lead. In order to make gongs (*lo*), &c., eight pounds of copper are alloyed with two pounds of tin. If you wish to make little bells or cymbals, the red copper and the tin must be much purer and finer than for gongs.

"When a gong is to be made, it must not

* The Chinese have two sorts of tin, mountain-tin and river-tin; both are found in the province of Kwang-se.

be cast in the form it is to have, and then forged with the hammer. You must begin by founding a thick sheet of metal, which must be cut round, and then beaten with the hammer. For this last purpose, the round sheet of metal must be spread upon the ground, and if the instrument is required to be of large size, four or five workmen must be placed around, to hammer it. The sheet will spread out and enlarge under the hammer, and its edges will rise up. Then the instrument will begin to emit sounds, resembling those of a musical cord. All these sounds proceed from the points which the hammer has struck (*lit.* from the points struck by the *cold* hammer.) In the centre of this drum of copper, a boss or round elevation is formed, which is struck, and the blows of the hammer give it the tone. Two tones are distinguished in the gong; the *male* tone and the *female* tone. Both depend upon the rising being less or greater than ought to be given, with rigorous exactness, to the boss, according as one or other is desired. By doubling the blows of the hammer, the instrument acquires a grave tone"

M. Darcet, in a note upon this translation, observes: "The only thing I find correct in this account is the composition of the alloy, of which the Chinese author states these instruments are formed. I have analysed seven gongs and twenty-two cymbals, and I have always found, in 100 parts, about 80 of copper and 20 of tin. It is true, about five or six years ago, an original letter was communicated to me from a missionary, which stated that gongs contained, besides copper and tin, $\frac{8}{100}$ of bismuth; but the properties of this alloy and the result of the analyses just mentioned, show that the workman deceived the missionary on this point. I regard then, as a fact proved, that these gongs and cymbals are composed of an alloy formed with 80 parts copper and 20 of tin; but this is far from sufficient to enable us to fabricate these instruments; for this alloy is as brittle as glass, and if it be used as it comes from the crucible, it would be not only impossible to forge it, but even to use such instruments, merely cast with this alloy, without their breaking. This happened to an untempered gong, which had been made at the school of Chalons for the king of Prussia, and to the gong at the opera, which being cracked, was heated in order that it might be mended with silver solder. The alloy of 80 parts copper and 20 of tin is so brittle, especially when hot, that it may be reduced to powder. This alloy has great density; its grain is very fine, and its fracture almost as white as that of bell-metal. Chinese gongs and cymbals, on the contrary, have a small specific gravity, and a fibrous fracture exhibiting the color of the alloy, of 90 parts copper and 10 tin, used for cannon. Fragments of gongs and cymbals, far from breaking under the pestle, are malleable, and may, moreover, be bent till the two sides of the piece form together an angle of 130 or 140 degrees, without breaking. It follows clearly from this comparison, that gongs and cymbals cannot be fabricated as the Chinese author pretends; that it is only by means of some peculiar process, some sleight of hand, that an alloy of 80 parts copper and 20 tin can be employed in this manufacture. This secret consists in tempering the alloy; in fact, when heated to a dull cherry red, and plunged into cold water, it takes instantly all the physical characters of the gong and cymbals: I have manufactured by this process upwards of sixty pairs of cymbals, and experience has fully justified what I have stated.

Nothing is said in the Chinese account about tempering; yet without this operation, it is impossible to fabricate these articles. As to the mode of making them, the alloy of 80 parts copper and 20 tin, even when tempered, cannot possibly be forced, and especially beaten out. All the Chinese author says about casting the alloy in the form of a plate and beating it out with the hammer, is a mere fiction, imposed upon him by a Chinese artificer, just as our artificers endeavor to mislead curious visitors in our manufactories. The following method is, in my opinion, the true one.

"The model of the instrument is forged in red copper or brass; to this model is given exactly all the desired forms, by making the face of the hammer penetrate more or less on the two surfaces, so as to form that continuity of spherical hollows and salient parts we see upon cymbals, and especially gongs. When the model is finished, it is employed to make a mould in sand, in putty, or in metal. An alloy of 80 parts of pure copper and 20 of fine tin is prepared, which is run into an ingot; it is then re-cast and run into the mould. The piece, when taken out of the mould, is rough-scraped; it is tempered as is done with steel. If it is misshapen, by plunging it red hot into cold water, the shape may be rectified by the hammer and by flattening it with gentle blows. The required tone may be given, either at first, by forcing the temper more or less, or afterwards, by hammering; it is polished by means of a lathe, as is done with saucepans of copper or brass, and the instrument is finished."

Buildings of Canton.—In the buildings of Canton, we have doubtless as great a variety of structure and style, and as fair

specimens of Chinese taste and art, as can be found in the whole empire. A large part of the city and suburbs is built on low ground or flats. Special care, therefore, is requisite in order to secure for houses and temples a solid basis. Near the river, and in all the most loose or muddy situations, houses are raised on wooden piles, which make the foundation as secure as brick or stone, and perhaps more so. In some cases, the piles rise above the surface of the ground, and then the buildings, constructed of wood, rest directly on them; but, in other instances, the piles reach only within a few feet of the surface, and the remaining part of the foundation is made of mud, brick, or stone. When this is done, the walls of the houses are usually carried up and completed with the same material. Not a few of the houses are entirely baseless, or have only a slender foundation of mud, of which also their walls are composed; and hence, in severe rain-storms and overflowings of the river, many of the walls are prostrated.

Bricks are in most general use for the walls of houses; perhaps three-fifths of the whole city are built of this material; of the remaining part, a very large portion is constructed of mud: most of the Tartars in the old city inhabit houses of this description. Stone and wood are not very extensively used for the walls of houses; the first is frequently employed about gateways and for door-posts; and the second for columns, beams, and rafters. Many of the floors of houses and temples are formed of indurated mud; marble flags are sometimes used for the same purpose, and often tiles. The latter, when made very thin, are used for roofs; they are laid on the rafters in rows alternately concave and convex, and forming ridges and furrows, luted by a cement of clay. Windows are small, and rarely supplied with glass; paper, mica, or shell, or some other similar translucent substances, taking its place. Very little iron is employed in building houses.

Such is the general style, and the usual material, of the buildings of Canton. In passing through the streets of the city, the spectator is struck with the difference he finds in its various buildings—though this diversity does by no means fully exhibit the relative condition and circumstances of the people. A few only are rich; and the external appearance of their houses does not at all exceed in elegance those of the middling class. Many are very poor; and the aspect of their habitations exhibits abundant evidence of their abject state. The poorest people are to be found in the extreme parts of the suburbs, along the banks of the canals, and in the northern part of the old city; their houses are mere mud hovels—low, narrow, dark, uncleanly, and without any division of apartments. A whole family of six, eight, ten, and sometimes twice that number of individuals, is crowded into one of these dreary abodes. It is surprising that people can live, and enjoy health, and even long life, in these circumstances. To pass through the streets or lanes of such a neighborhood, is sufficient to reconcile a person to any ordinary condition of life. Neither intelligence nor industry could ever be confined in such miserable cells.

In habitations a little more spacious and cleanly than these, perhaps one-third part of the population of Canton have their abodes. These stand close on the streets, and have usually but a single entrance, which is closed by a bamboo screen suspended from the top of the door. Within these houses there are no superfluous apartments: a single room, allotted to each branch of the family, serves for a dormitory, while a third, which completes the number into which the whole enclosure is divided, is used by all the household as a common eating-room. Chinese houses usually open towards the south; but in these, as also in the poorer kind, this favorite position is disregarded. Houses of this description are rented at four or five dollars a month.—[Chinese Repos.]

A table of the comparison of weights and measures, very useful in many calculations.

One oz. troy of water, at 60° temperature, occupies 1.900945 cubic inches.

One wine pint of water weighs 7291. 11075 grs. Troy=1.26581783 lbs. Troy =1.04158725 lbs. avoirdupois.

One ale pint of water weighs 8900.8365 grs. Troy=1.545284 lbs. Troy=1.271548 lbs. avoirdupois.

One lb. Troy of water occupies .7900031 wine pints=.6471302 ale pints.

One pound avoirdupois of water occupies .960073 wine pints=.7864429 ale pints.

A cubic inch of water at 60° thermometer, and 29.5 barometer, weighs 252.506 Troy grains.

A cubic foot of water weighs 909 oz. 10.368 grs. Troy.

Troy.
- One grain Troy=.00396 cubic inches
- One drachm .23718 cubic inches,
- One ounce 1.200945 cubic inches,
- One lb. of water 22.81134 cub. inches,

One pound Troy=0.82285714 lbs. avoirdupois.

One pound avoirdupois=1.215277 lbs. Troy.

[From the Journal of the Franklin Institute.]

Specification of a Patent for an Improvement in the Mode of Chilling Cast Iron Wheels for Railroad Cars. Granted to PHINEAS DAVIS, Civil Engineer, city of Baltimore, July 29, 1834.

Whereas, it has been found that, in the casting of what are called chilled wheels, for railroad cars, that the part of the wheel which is most liable to wear, namely, the rise, cone, or curve, between the tread of the wheel and the flanch, is usually less hard than the other parts, for the obvious reason that the metal is there less rapidly cooled by the chill.

Those acquainted with the business of casting iron, are aware that the operation of chilling consists in placing within the mould, so as to make a part thereof, a piece, or pieces of iron, which, when the metal is poured in, rapidly cools that portion with which it is in contact, and renders it hard. In the casting of wheels for railroad cars, the chill consists of an iron hoop, of considerable thickness, and with which the whole face of the wheel, including its flanch and tread, is in contact; but from its form, as I have already indicated, there is one part of it, uniting the tread with the flanch, which is less rapidly cooled than the others. To remove this difficulty, I employ what may be denominated an internal chill; this consists of an iron hoop, or ring, which I usually form of round rods, half an inch in diameter, giving to the hoop, or ring, such a diameter as shall cause it, when laid in the flask, and the casting made, to be surrounded by, and completely imbedded within, the cast metal, and to stand about half an inch within the body of that part of the wheel which forms the curve, or cone, before spoken of, and opposite the centre thereof. But as, in the usual thickness of the rims of such wheels, the said ring would be covered on the inside by only a thin shell of metal, I form such a bead, projection, or thickening, opposite thereto, on the inside of the pattern of the wheel, as will cause the metal to cover it, about three-eighths of an inch.

Iron-founders are well acquainted with the means of supporting such articles as the before described ring, within the flask, so that they may be embraced within the cast metal. The method which I have adopted of effecting this in my wheels, is the following. I take four strips of iron, which may be one-tenth of an inch thick, one-fourth of an inch broad, and four or five inches long, and one end of each of these I bend round the ring, so as to clasp it tightly, the remainder of the strap forming a shank, or bearing, which rests upon the sand in the lower flask. These clasps stand at equal distances apart, and, when in the mould, point toward the centre of the wheel. The pattern must be so made, that the parting of the sand in the flask will be opposite to the centre of the ring. Facing sand, of the usual description, should be used in making the mould. The ring, before being placed in the mould, should have its surface made bright, by filing, or otherwise. It must also be heated, say to the temperature of boiling water, to dissipate any moisture, or other evaporable matter, which might otherwise cause it to blow. The casting should be performed immediately after placing the ring in the flask.

Although I have described the mode of procedure in casting, and in other parts of the process for forming wheels within which are imbedded a ring of wrought iron, I do not claim these as making any part of my invention; but I do claim the using of a hoop, or ring, of wrought iron, to be laid and cast within the body of a railroad wheel, in such manner as to operate as an internal chill, to cool more rapidly, and consequently to harden, the part which I have described under the name of the curve, or cone thereof; I claim no more. PHINEAS DAVIS.

[From the same.]

Specification of a Patent for Promoting the Combustion of Anthracite in Locomotive and other Steam Engines. Granted to PHINEAS DAVIS, Civil Engineer, city of Baltimore, July 29, 1834.

The means by which I promote the combustion of anthracite, or other fuel, is by the employment of fan wheels, or vanes, revolving within drums, in a manner well known to machinists; and my improvement consists in the arrangement of the apparatus by which I employ the waste, or escape steam, to give motion to such fans, or vanes. For a locomotive engine, I usually employ two fan wheels, and I have found them, and their appen-

dages, to answer well in practice, when made of the dimensions which I am about to indicate, although, in this particular, there may be considerable variation, without injury to the effect. The wheels may be from eighteen to twenty inches in diameter, and from ten to twelve inches wide; they may be placed upon the same axis, and at the distance of about eighteen inches from each other in the clear; in many instances, two vanes to each wheel will be sufficient, but a greater number may be used; the drums within which the wheels revolve do not differ from those ordinarily employed in similar blowing machines. The wind is conducted from these drums through tubes seven or eight inches square, which lead from them in the direction of a tangent to the circle described by the wheels, into a tight ash-pit under the grate of the furnace; and the air is thereby forced through the fuel with such velocity as to cause the fire to burn with great energy, so as to produce an abundant supply of steam from anthracite, notwithstanding the tendency of that fuel to pack, and thereby to impede the ordinary draft, when employed for locomotive engines.

In order to give motion to the fan wheels, I place a steam wheel upon the same shaft with them, generally at the centre thereof, so as to be equidistant from them. This steam wheel is constructed in the same manner, nearly, as the wind wheels, differing from them principally in its dimensions, and its being acted upon and impelled by an elastic fluid, (steam,) whilst they act upon and impel an elastic fluid, (air.) The steam wheel has usually four wings, or vanes, from three to five inches in width; and it may be from twenty to twenty-four inches in diameter. This wheel is enclosed within a drum, of such dimensions as just to allow the vanes to revolve freely within it. A tube connected with the exhaust pipe, from each end of the cylinder, enters the drums tangentically, and the waste steam is thus injected forcibly against the extreme ends of the vanes, impelling them, and consequently the wind wheels, with great velocity. The steam which thus enters escapes at an opening, or openings, in the centre of the drum, made similar to those at which the air enters from the action of, and to supply the, fan wheels.

As it is necessary to command the blast, so as to regulate the intensity of the fire, which would often be too great were the whole of the waste steam discharged upon the steam wheel, I attach a branch pipe to that which conducts the steam from the cylinder, or cylinders, to the steam wheel, and employ a valve, or valves, so arranged as to enable me to direct the whole, or any desired portion, of the steam, through such branch pipe, and thus attain the desired object in the most perfect manner.

The continued fresh supply of steam, and the diminished centrifugal force of that which has acted upon the vanes, continues, however, to operate until the moment of its escape at the opening surrounding the centre, provided the parts are properly proportioned to each other, for although its energy is diminished, so also is the actual velocity of the vane, as the centre is approached.

The opening in the steam wheel, for the escape of steam, I usually make on one side only, and cover this with a cap, or drum, and from this cap, or drum, a tube extends upwards to carry off the steam in such a way that no inconvenience may be experienced by its discharge.

Although I intend always to use the waste steam from the cylinder, or cylinders, it is manifest that steam may be supplied from the boiler, to act upon the steam wheel; but this procedure would not be economical, and would yet be a manifest invasion of my rights.

I am aware that wind wheels, such as I have described, have been used to supply a blast to the furnaces of locomotive engines; I am also aware that wheels have been propelled by the action of steam upon wings, or vanes, surrounding them; I do not, therefore, claim either of these, singly and separately, as my invention; but what I do claim is the combination and arrangement of the parts such as I have described, by which the waste, or escape steam, is made to act upon vanes revolving within a drum, for the purpose of giving motion to wind wheels, to feed the furnaces of steam engines.

And I do hereby declare, that I have herein explained and set forth what I believe to be the best method of applying the waste steam to accomplish the proposed object, but that I do not intend thereby to

confine myself to this precise mode of construction and arrangement, but to vary the same as I may find convenient, whilst I operate upon the same principle, and attain a like end by analogous means.

PHINEAS DAVIS.

[From the Journal of the Franklin Institute]

Extract of a Report upon the Employment of Hot Air in smelting Iron with Charcoal. By M. E. GUEYMARD, Engineer-in-Chief of Mines.

A successful experiment in the smelting of iron by the aid of the hot air blast, has been made at the furnace of Riouperoux, (Depart. of Isere.) In this furnace, the distance from the blowing machine to the tuyere was insufficient for the erection of the apparatus for heating the air which the machine furnishes; they were obliged, therefore, to make the conduit pipe semicircular.

Six kilns, or ovens, were made with one chimney, 54½ feet, (French,) high, placed against the stack of the furnace. The fuel used in them was anthracite, which was applied to heat a pipe eight inches in diameter, and ten feet long; the part of the tube which traverses the fire was protected by a coating of fire clay, one inch thick, covered by a shield of cast iron, which received the direct action of the fire.

Five months' work have proved the efficacy of this arrangement; the expense of the construction of the apparatus for heating, including a tube for water, amounted to the sum of 5,009 francs, (1,001 dollars.)

Upon the blast pipe, and close to the tuyere of the furnace, is placed an air gauge, and a thermometer. The consumption of fuel by the air oven has been fixed at 150 kilog. (300 lbs.) of anthracite in twenty-four hours.

The experiments were commenced on the 3d of April; the fires were lighted in succession, and, on the 15th of May, five of them being lighted, the temperature of the air was raised to 125° R., (313° Fah.) and even as high as 130° R., (324° Fah.)

Before the introduction of hot air, the furnace was charged each time with 65 kilog. (130 lbs.) of soft charcoal, and with 77 litres (2¾ cubic feet) of ore.

Gradually the hot air was introduced, the temperature being raised more and more. They have been able to use with the same load of charcoal, quantities of ore increasing as 82, 87, 91, 102, and up to 105 litres; a quantity which has not been exceeded. It was observed that, at this maximum charge, the scoria, or slag, was more liquid, and the metal of a better quality, and finer than before.

The consumption of the five fires was 750 kilog. (1500 lbs.) of anthracite in twenty-four hours.

When they worked with cold air, the mouth of the tuyere was eighteen lines, (1½ inches,) in diameter, and the pressure of the air equalled twenty-four inches of water. Upon the introduction of the hot air, the diameter of the mouth was increased to twenty lines, (1⅔ inches,) and the pressure decreased to twenty inches. The number of charges were forty in twenty-four hours, in the first case; but in the second, they could not exceed thirty-four or thirty-five. Afterwards, having restored the pressure to twenty-four inches, they were enabled to increase the number of charges to forty.

The economy of fuel by the use of hot air, at the furnace of Riouperoux, may be estimated by the results of the castings made during the month of June, being about the average of three months' experiments, and about the same with those of the months of July and August.

During the month of June, 57,989 kil. of pig iron were made by the consumption of—Ore, 110,400 litres; charcoal, 1,104 charges.

To obtain the same quantity of metal by using the cold air blast, would have required 1,434 charges of the same charcoal. There was, therefore, a saving of 330 charges, of which the value, at 5 frs. per charge, = f. 1,650

Add 8 days' work of workmen, at 19.36 f.,	154.88	
	1804.88	= $360.98
Deduct for the expense of heating the air,		
Attendance of fireman,	45	
21,500 kil. anthracite,	516	
Interest, 10 per cent., on cost of the heating apparatus,	41.10	
	602.10	= 120.42
	f. 1202.78	= $240.56

The benefit resulting from the employment of hot air was, for one month, 1202.78 francs, ($240.56,) or 2,072 f. ($4.14,) per 1000 kilog. (20 cwt.) of the casting produced. This is the minimum gain. Since, the general expenses are not given, and refractory mixtures of ores have frequently been used, during the month of June. It must be observed that the saving of 21,450 kilog. (42,900 lbs.) of charcoal, made in the casting, had required a consumption of 21,500 kilog. (43,000 lbs.) nearly an equal weight of anthracite, of which the value is much less than that of charcoal.

The tuyere was burnt through three or four times in twelve hours, an inconvenience which was remedied by surrounding it with water, after which the working of the furnace became perfectly regular.

The sixth fire having been lighted, the temperature of the air was maintained at 130° R. (324° Fah.), and was sometimes raised above ; but no change was found in the working of the furnace, nor could the charge be increased beyond 105 litres ($3\frac{3}{4}$ cubic feet) of mineral, to 65 kilog. (130 lbs.) of charcoal.

The dimensions of the tuyere mouth, and the pressure of the air, were varied, and the results were always inferior to those already stated ; so that the maximum effect produced, with the mixture of ores employed, was, with a pressure of twenty-four inches of water, a diameter of tuyere of twenty lines, the temperature of the blast, 130° R. (324° Fahr.) and 105 litres of ore to 65 kilog. of charcoal.

A mixture of more refractory ores than the preceding, and which could not be smelted with the cold air blast, was reduced with much facility, but the charge of ore could not exceed 100 litres. It should be remarked, that the temperature of the blast, which appeared to give a maximum effect at temperatures not exceeding 130° R., was much below the temperature of melted lead, (604° Fah.) to which it had been carried in the experiment made at Vienna in a coke furnace.

Remarks on the foregoing, by the French Editor.

1. M. Gueymard has correctly observed, that unless the air can be heated by the flame which issues from the mouth of the charcoal furnace, those who are not able to procure a cheap combustible for the heating furnace, and continue to work with cold air, must be most unfavorably situated.

Happily, the attempts made in Germany, and the apparatus there contrived, and which has already been imitated in France, have shown that the flame which escapes from the furnace will heat to a proper temperature all the air which is required. It is recommended that at furnaces where charcoal is used, the heat which would otherwise be wasted shall thus be used, instead of the separate apparatus for heating air, thus augmenting the profits of smelting with heated air, by the whole value of the combustible consumed in the fires.

Thus at Riouperoux, the saving which has been made of 1202.10 fr. will be carried to 1763.78 fr. per month, or to 30 fr. per 1000 kilog. of iron produced, in place of 20 fr.

2. The best plan yet presented for heating the air by the flame at the top of the furnace is the following, which differs a little from that employed at Wasseralfingen, and described by M. Volz. The air required for the blast is passed through twenty small columns or vertical tubes, four feet long by two inches and a half in diameter, which are placed in a space or oven near the mouth.

By this means, the air is more heated, and there is less friction, than by passing it through a long tube horizontally, because the air passes slower, and has only four feet to traverse.

The diminution of the resistance to be overcome by the blowing machine is considerable and very important, because the water courses are frequently hardly sufficient, during the summer, to furnish the quantity of air necessary for the consumption of the iron furnaces.

3. The temperature of the air thrown into the furnace of Wasseralfingen, has been raised constantly to 165° R. (403° Fahr.) and often to 210° R. (504° Fahr.) with increased effect.

M. Gueymard, on the contrary, has observed that the production of iron was not augmented by an elevation of the temperature above 130° R. (324° Fahr.)

At Wasseralfingen, with the air heated to a temperature varying from 165 to 210° R. (329 to 400° Fah.) to produce

1000 kilog. (2000 lbs.) of iron, 1130 kil. (2260 lbs.) of charcoal was consumed, in place of 1730 kilog. (3460 lbs.) burned when the cold air was used. The weekly production has been carried from 527 local quintals to 734 quintals—equal to 357 metrical quintals, (lbs.)

At Riouperoux, with the air heated to 130° R. (266° Fahr.) they have consumed for 1000 kilog. (2000 lbs.) of castings, 1270 kilog. (2540 lbs.) of soft charcoal, in place of 1610 kilog. (3220 lbs.) with cold air.

The differences between the results obtained in these furnaces are not considerable. It is remarked that in both the quantity of charcoal consumed in twenty-four hours is not augmented, but the charge of coal, and the daily produce of casting, has, by the employment of the hot air blast, received a considerable increase.—[Annales des Mines.]

[From the same.]

Report to the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. Dufrenoy, Engineer of Mines. Paris, 1834.

Some experiments by Mr. Neilson, Director of the Glasgow Cas Works, led him to think that advantage would be gained by previously heating the air to supply the smelting furnace. He communicated his ideas to Mr. Mackintosh, long known for his inventive genius, and they united in undertaking at the Clyde Iron Works, in concert with Mr. Wilson, one of the proprietors of the establishment, a series of experiments to determine this important question.

In the first experiment, the air from the blowing machine was passed through a rectangular trunk of sheet iron, ten feet long, four feet high, and three feet wide, where it was heated previous to its entrance into the furnace.

Notwithstanding the imperfection of this method, by which the temperature of the air could not be raised above 200° Fahr., it was evident from the experiment that the plan of Mr. Neilson was destined to produce a revolution in the manufacture of iron.

This first apparatus was soon destroyed by the action of the heat, and its renewal being very costly, they substituted a cast iron pipe, having in the middle an enlargement like the bulb of a thermometer.

This second apparatus produced beneficial effects; it lasted much longer, and the temperature of the air was raised by it to 280° Fahr. This increase, though small, produced a visible economy in fuel. Messrs. Neilson, Mackintosh, and Wilson, then understood the advantages which would result from raising the temperature many hundred degrees. They abandoned this heating tube, and constructed a new apparatus, presenting a great number of tubes, heated in many points of their length. By this means, the temperature of the air was raised to 612° Fahr., a temperature above that of melted lead.

Though this temperature was much below that required for smelting iron, (estimated at about 1500°) it produced a considerable saving in the consumption of fuel. Another advantage was obtained of great importance—that of being enabled to substitute crude coal for coke, without injury to the walling of the furnace. The quality of the iron was, on the contrary, improved, and the furnace, which produced but little more than half its quantity of No. 1 and half of No. 2, when fed with coke, gave a proportion much greater of No. 1 iron, after the substitution of crude coal. Besides, the consumption of fuel was considerably diminished. This last circumstance was owing, probably, to the fact, that the temperature of the furnace becoming higher, it was not necessary to add so great a quantity of flux to insure the vitrification of the gangue which accompanied the mineral. It is probably owing to this elevation of temperature that coal may be substituted for coke.

The better to judge of the progressive increase of economy obtained at the Clyde Works, in the experiments to be noticed, we give for each of them the different consumptions of coal and flux.

In 1829. The combustion being maintained by cold air—

	Tons.	cwt.	qrs.
Coal. 1. For fusion, three tons coke, corresponding to	6	13	0
2. For the blast engine . . .	1	0	0
	7	13	0
Flux		10	2

In 1831. The furnace being in blast with air heated to 450° Fahr., they still burnt coke for the fusion of the metal—

		Tons.	cwt.	qrs.
Coal.	1. For fusion, 1 ton 18 cwt., corresponding to	4	6	0
	2. For the heating apparatus . .	0	5	0
	3. For the blast engine	0	7	0
		4	18	0
Flux			9	0

In 1833, July. The temperature of the air was raised to 612° Fahr., and crude coal used for fusion—

		Tons.	cwt.	qrs.
Coal.	1. For fusion . .	2	0	0
	2. For the heating apparatus . .	0	8	0
	3. For the blast engine	0	10	0
		2	18	0
Flux			7	0

At this last epoch, the employment of heated air had augmented the yield of the furnace more than one-third, and consequently had effected a great saving in labor. In fine, the quantity of air required to maintain combustion in the furnace was also found to be sensibly diminished. The blast engine of seventy horse power, which was sufficient in 1829 for only three furnaces, was found of ample power for the blast of four.

By comparing the results which will be indicated, it will be perceived that the economy in combustion is in proportion to the increase of temperature. As to the absolute saving, it varies in each furnace according to the nature of the coal, and the care used in carrying on the operation.

In spite of the complete success of these experiments, the introduction of heated air into the iron works encountered great difficulties. It was necessary to conquer not only the power of habit, but the prejudice generally existing, that the coal is sulphureous, and that its transformation into coke is not only favorable to combustion in the smelting furnace, but that it is indispensable to the making of iron of good quality.

This plan, in use four years in the environs of Glasgow, which it has saved from certain ruin, has scarcely passed the frontiers of Scotland. However, the wonderful advantages which it has produced, have began to triumph over these prejudices, and gradually to extend its use in the different provinces of England. I know of twenty-one works containing sixty-seven furnaces, which work with hot air. In Scotland, six; Flintshire, one; Derbyshire, three; Newcastle-on-Tyne, two; Newcastle-under-Line, two; Staffordshire, five; Pontepool, two. Total, twenty-one.

The iron made at these furnaces is generally No. 1, proper for casting the nicest work.

The plan is equally applicable to the metal intended for bar iron. To obtain this quality of metal it is only necessary to change the proportion of fuel and mineral. The forges upon the Tyne Iron Works, near Newcastle—of Codnor Park, near Derby—employ for the manufacture of bar iron, none but the pig metal produced in the hot air furnaces.

In most of the establishments cited, the crude coal has been substituted in place of coke. In some works, where this substitution has not yet been adopted, they assured me, as at Monkland Iron Works, near Glasgow, that the temperature of the air was not raised sufficiently to enable them to pass from the manufacture by coke. In some others, the quality of the coal being extremely bituminous, as near Newcastle, appeared to be an obstacle to the use of coal in the natural state.

The employment of hot air is not yet introduced into the great works at Merthyr Tidvil, Wales. The small consumption of coal which is employed crude, as I shall indicate at the close of this report, and the high price of the patent, has retarded its adoption; but I have no doubt that this plan will produce in this country a sensible saving in the consumption of fuel.

To appreciate the advantage which results from the employment of hot air, I shall give a statistical view of the works visited. I will describe the apparatus as far as they differ from each other; and I will compare the consumptions and expenses incident to the production of a ton of iron, before the introduction of hot air, and at present. This description will no doubt appear tedious, but in so important a question, and one which may have im-

mense influence upon our forges, I think nothing should be omitted tending to instruct our iron masters. I will then give some details upon the coals used in these works, and upon the expenses of manufacture in the Welsh works.

Finally, I will terminate the report by a recapitulation of the principal experiments which have been made in France to introduce the use of hot air in the iron works.

Before commencing this description, I should pay a just tribute of acknowledgment to the proprietors of the works which I have visited. Almost all have procured me, with a noble generosity, the means of studying their establishments with advantage. They have shown, in this circumstance, that the sole rivalry which exists between France and England is that of emulation.

[*To be continued.*]

[From the American Railroad Journal.]

Remarks relative to the Steam Engine.

Sir,—If you consider the following remarks relative to the steam engine worthy of attention, oblige me by giving them a place in your Journal.

In all machines it is a desideratum, that just such an amount of power should be applied as is necessary to produce the desired effect. When the effect to be produced requires different degrees of power at different times, the machine should be so arranged as to be able to exert more power at one time than at another; and it should at no time exert a power greater than is necessary to produce the effect required at that time. The want of thus apportioning the power and effect is obvious in many cases where steam is used, particularly so when it is used as the motive power on rail and other roads; and a great waste of power is the consequence.

In cases where locomotive steam engines are used on railroads, which are undulating, or various in their grades, it is common to give them such loads as they are capable of moving up the steepest ascents which they are expected to encounter between their places of starting and destination. If they are expected to pass ascents of 24 feet to the mile, they only take half the load which they are capable of moving on a level, and if they have to pass descents of that inclination, as well as ascents, they have nothing to do while they are thus descending. When stationary steam engines are used to draw boats or cars up inclined planes, they are generally idle during a considerable portion of their time, yet the steam must be kept at its full pressure, so as to be ready for any work which may offer.

In order to prevent this waste of steam when used as the *primary power*, it is proposed to employ the engine during its moments of ease and leisure, in condensing atmospheric air, which condensed air will be used as a *secondary* or *reserved power*, and be applied to assisting the engine when it has the most to do.

The atmospheric air to be condensed in air chambers of *globular*, *cylindrical*, *oval*, *rectangular*, or other shape, as may be found best suited to the case, and to be made of copper, iron, or other suitable material.

The air to be passed from the air chamber, through *hot tubes*, to one or more working pistons, similar to the pistons of a high pressure steam engine; the tubes to be kept at as high a temperature as is found expedient, so that the air may enter the cylinder of the working piston rarified as much as possible, whilst the air in the chambers will be kept at a low temperature by surrounding them with a non-conductor of heat. Although the use of the hot tubes will greatly tend to economise the use of air, it may not be found expedient to use them in all cases.

In cases where *globular air chambers* are used, they may be provided with *air measures*, so that, although the air in the chamber may have a pressure greatly exceeding that necessary for producing the desired effect on the working piston, yet such a quantity only shall be let out at one time as is necessary to produce that effect. This may be done by having something like a safety-valve to the measure, so adjusted as to shut off the supply of air from the chamber at the moment it raises.

In cases where the air chambers have a shape other than globular, they may be provided with a *piston* so arranged as to

decrease the size of the chamber as the air is used; that is, for each cubic foot of air used by the working piston, the air chamber shall be reduced in size one cubic foot, by which means the full pressure of air will be kept up, until it is all exhausted. These pistons may have a vertical or a horizontal motion, and may be forced into the chamber by *levers and weights*, *cords passing round drums*, or *cog wheels working in racks*.

After the air has produced the desired effect on the working piston, it is proposed to pass it into the fire of the engine, so as to hasten the combustion of its fuel.

When locomotive engines have not weight enough to produce the necessary adhesion, it is proposed to connect the wheels of the engine with those of its tender, and, if necessary, with those of several of the loaded cars following next after it. The forward and after wheels of the engine and cars may be connected by *cranks* and *connection rods*; and the wheels of one car with those of another, by *chains*, with suitable *links*, passing round *cog wheels* fixed on the middle of the axles. The chains may be made to work tight on the cog wheels by *pressure wheels*, to be so arranged as to cause the two sides of the chain, that is, the sides of the chain above and below the cog-wheel, to approach each other, and to operate only when necessary.

An engine having the two kinds of power thus combined, it will be proper to entitle the *Pneumatic Steam Engine*, and the advantages which must result from the combination are obvious.

The capacity of the ordinary locomotive steam engine used on railroads, must be greatly increased by it; in some cases it may be doubled. Even when it is used on level roads, it is often difficult to keep up the pressure of steam. By having condensed air on hand, the deficiency of power on account of the low pressure of steam will not only be supplied, but the combustion of the fuel hastened, and consequently steam generated more rapidly, at the very time when it is most wanted.

By combining the secondary and primary power, in steam engines at the head of inclined planes, the steam engine need only have a power equal to the whole amount of work to be done, instead of a power equal to the elevation of the heaviest load, which may be offered at any one time.

The great difficulty in the way of using steam carriages on common roads,—viz., too much weight for their power,—will be measurably removed by the combination.

The combination may be used for the purposes of regulation and economy, in all cases where the steam engine is called on to exert a greater force at one time than at another, and where the intervals of time, during which the greater force has to be exerted, are too long for the advantageous use of the *fly-wheel;* and it may be used with advantage as a regulator of hydraulic as well as steam power.

In submitting the above remarks to the public, I am fully aware of the danger which surrounds me, in common with other inventors: that of being blinded by my partiality to the products of my own mind. Perhaps I have already fallen into the snare; certain it is, that if there are any insurmountable difficulties in the way of making the combination, I cannot see them; but I wish to get at the truth, and therefore invite criticism.

Respectfully,

J. D. Steele, Jr.

Ellicott's Mills, Md., Feb. 15, 1835.

Infantile Instruction.—Madame D' Arbly, a daughter of the celebrated Dr. Burney, whose writings place her on the catalogue of the most talented females of the age, during her childhood was the most backward of all her family, in receiving instruction. At eight years of age she was totally ignorant of the letters of the alphabet. No truth was ever more palpable, than that forcing infants to the drudgery of learning the ten thousand lessons which are prepared for them as soon as they leave the cradle, is diametrically opposed to the clearest indications of nature. It is characteristic of an intelligent being, placed in civilized society, to imbibe a taste for those pursuits which give pleasure to its superiors in age. When the physical powers are developed, the sensorial powers begin to exhibit their tendencies; in a word, when children have obtained a free use of their limbs, the period has arrived for commencing the culture of the mind.—[Scientific Tracts.]